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INVESTIGATIONS REGARDING THE CONDITIONS DETERMINING THE QUALITY OF CHEESE.

RESULTS OF TRIALS AT RUKUHIA.

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WHAT is known as the Rukuhia Experiment was the outcome of a request that the Dairy Division of the Department of Agriculture take control of a cheese-factory for a season in an endeavour to throw some light, if possible, on various factors affecting cheese quality.

The Rukuhia Factory, a branch factory of the New Zealand Co-operative Dairy Co., Ltd., was selected, and actual control of the manufacturing operations commenced on the 1st October, 1933. Prior to this there had been consultations with the suppliers, fifteen in number, and their co-operation solicited.

It was arranged that each farmer be supplied with a milk-cooler and also a "Hauraki" steam sterilizer, where such appliances were not already installed.

The Live-stock Division undertook a monthly examination of all cows supplying the factory for mammitis, and each supplier agreed to sample every cow in his herd, this being supplemented by can samples taken at the factory. A report from Mr. Kidd, Bacteriologist, shows the average percentage of infection from cow samples as 18 per cent. and from the can samples as 21 per cent., which is believed to compare fairly favourably with other groups tested in neighbouring districts.

The present manager, Mr. A. Laurent, in 1928 during his first season obtained results which could be classed as very fair. The next season he carried on much in the same manner, and for the greater part of the season had what may be termed a "good run," easily making close cheese of high-scoring quality, and he has often stated that, "no matter what he did, it was right." Since then, however, he has manufactured only a fair quality cheese, his main trouble being slit-openness.

EQUIPMENT AND MATERIAL.

Rukuhia is a typical four-vat branch factory, the plant and buildings being in very fair order. For the investigation a Berry Staybright starter heater and Dr. Moir's mother-culture outfit were made available. Both these units were of value to us in the care of our starters, there being no real cases of starter failures, and acidities were easily controlled.

The milk was graded daily, the curd and reductase tests being supplemented twice weekly by the Breed count method. Milk quality generally was quite good, but it is significant that, even in this group of fifteen suppliers, who were exercising special care, there were a number of instances where curd samples were second-grade on flavour, and from inspection of the milking plants it was quite evident that the greatest care was not being taken with the cleaning. A certain amount of this was due to lack of knowledge, and it is pleasing that where a supplier was advised no further trouble in this direction occurred. Curd-testing was operated by the Wilkins curd-testing machine, which proved very useful, being easy to operate and productive of a good curd. It was found that during the spring months relatively low cooking temperatures had to be used and the agitation time reduced, as with normal temperatures and times the curd at grading was much too hard and dry. During the autumn months some trouble was experienced with feed flavours and soft mushy bodies. This condition of body was not always easily accounted for, because there were several suppliers whose curds were quite normal, even although their feed was equally as dry as others and their percentage of mammitis milk as high. Neither the reductase, Breed count, or non-acid tests showed any of these milks as abnormal. A perusal of a soil-map of the farms in the district, compiled by the Department of Scientific and Industrial Research, does not permit of definite conclusions, although it is significant that curds from the milk of those farms consisting of larger proportions of Te Kowhai sandy loams were as a rule softer in body than others. This condition applied independently of climatic conditions and of the quality of the milk from a sanitary viewpoint.

The temperature of the night milk delivered at the factory was generally below 65°,* but during the warmer weather it was found, in most cases, that this standard could not be reached. The highest temperature recorded was 70½°, but only on rare occasions was this encountered.

The most general type of cooler in use on the farms was the ripple chute, there being twelve of these, two jacketed pipe, and one Victory vertical tubular. All gave good results providing sufficient attention had been given to the water-supply.

The Hauraki steam sterilizers, on the whole, gave good results when used in the proper manner. The mere fact of placing a sterilizer in a milking-shed does not, however, make a careless person careful, nor an unclean one clean, and it was found on a few occasions that a little too much reliance was being placed on the sterilizer, rather than on the previous application of boiling water and soda. The result was that milk scale formed rather rapidly, and until this was removed and the normal system prior to sterilization reverted to trouble with the milk quality was experienced. There were two suppliers who did not use the sterilizers, relying on electric heaters for the water for cleansing, and as they were both naturally " good " suppliers no trouble was experienced with their milk. It is believed that both electric heaters were fitted with a " booster " element.

The average butterfat content of the milk during the period of our control was 4·24 per cent., which in the North Island is a medium fat

* Temperatures given throughout in Fahrenheit.

content. Each vat was tested daily for fat, and during the latter part of the season numerous casein tests were made. At times quite wide variations were noted, both from vat to vat and day to day, being, of course, widely affected by climatic changes. Several tests of all milks supplied were made for added water, and some suppliers were cautioned regarding a rather high percentage, presumably of rinsing water. It was found during the latter part of the season that a number of suppliers were not reducing their rinsing quantities in proportion to the lower amount of milk.

Practically all the milk was pasteurized, the regenerator being an ordinary two-dome Topliss. This machine was fairly satisfactory, although, owing possibly to the heavy material of which the outer dome is constructed, rather low regeneration, about 28°, was obtained. Pasteurizing temperatures were kept within fairly normal limits, ranging from 150° to 155°, the milk being, of course, well circulated both at commencement and finish of each run.

Water-supply and Drainage.—The water-supply at Rukuhia could be classed as fair, consisting of a well and a deep bore. Well water was good, but unfortunately formed only a small part of the total, especially during the autumn. The bore water, although plentiful, was of high mineral content, and not at all clear, having a distinct blue tinge and a strong odour upon standing for a day or so. Rusty deposits also soon formed in all pipes, &c., with which it came in contact.

All drainage was run into a concrete underground tank, from which it was pumped to a stream about a mile distant, the system proving satisfactory in operation.

Whey-tank.—This is constructed of wood, being cylindrical in shape and well kept. Piping to and from this tank is of ordinary galvanized iron, but as steam connections are fitted, both at the whey-pump in the factory and at the delivery pipe, it was possible to maintain a reasonably sanitary condition. No delivery hose is used, a system of loosely screwed 2 in. bends being quite effective and much more sanitary than either a rubber or leather hose.

Curing-room.—The curing-room at Rukuhia is very fair, having insulated walls and ceiling, and being separated from the making-room by a storeroom passage. Morganite thermostatically-controlled heaters are fitted, but unfortunately no provision is made for mechanical cooling. During the summer months a few high temperatures were recorded, but usually temperatures were slightly below the summer average for this district. The highest temperature was 74°, highest daily average 68½°, the highest relative humidity 95°, and the lowest 70°. Little trouble with mould-growth was experienced, this being kept in check by daily washing of the cheese-shelves, and frequent sulphur fumigation during periods of high humidity. No trouble was experienced with either damp or cracked rinds, and practically all cheese were coated with wax, the waxing-machine being installed in a small room adjacent to the curing-room.

Rennet, Colour, and Salt.—New Zealand rennet and colour were used exclusively, the rennet giving normal coagulation at 2½ oz. to 2¾ oz. per 1,000 lb. milk, whilst the amount of colour added varied from 1½ oz. to 3 oz. Even at the higher rate, it was often difficult to obtain the desired shade of colour, and in several reports, both from

the Auckland graders and the Department's officers at London, it was remarked that the colour was rather pale and indistinct. Glacia salt was used exclusively and proved quite satisfactory, and the storeroom was good.

Starter.—The starter milk was taken from the same supplier right through the experiment, this supplier being probably the most satisfactory one from a cleanliness viewpoint, and he also milked only "A" class cows for the starter supply. On vitality and non-acid tests, apart from the three grading tests, this milk was probably the best at the factory. The Berry heater proved very satisfactory in operation, apart from a little trouble with the dial thermometer, which required frequent checking. The maximum temperature was maintained for at least one hour, care being taken to avoid caramelization of the milk sugar. This machine is well insulated, and the milk was, as a rule, set at about 68° with 0·125 per cent. of culture, resulting in about 0·80 per cent. acidity the following morning. Heating temperatures in the mother-culture outfit were about the same as the main starter, but cultures were set lighter, a lower acidity being the general aim, and 0·80 per cent. being desired as the maximum figure at about six hours later than in the main starter.

Curd Knives.—The standard set of $\frac{3}{8}$ in. (22 blade) curd-knives as used previously in the factory was supplemented with a $\frac{5}{16}$ in. (24 blade) set, the finer cut, especially during the autumn months, giving much more satisfactory results.

Manufacture.

October.—From the commencement, what may be termed normal manufacturing methods were adopted, with a view to ascertaining if methods used previously in the factory had been a contributing factor in relation to slit-openness. During the earlier part of the season, prior to taking control, some trouble had been experienced with sweet cheese, a portion having been second-graded for this defect.

The immediate aim was therefore along the lines of more acidity, but it is worthy of note that although we were "drying" the curds at 0·285 per cent. and 0·29 per cent., and obtaining anything from 1 per cent. to 1·11 per cent. of acidity at three hours from drying and 1·10 per cent. to 1·18 per cent. at three hours and a half, the first twelve days' make was considered by the Auckland graders to be a little on the sweet side. These cheese also showed, apart from slittiness, a certain amount of mechanical openness due possibly to the lack of acidity. A notable feature, however, was that by the time these cheese had reached the London market acidity had developed nicely, and, according to the London officers, were right for acid and body, and, apart from some mechanical openness, nice-quality cheese.

During the latter half of October acidity at drying was increased to 0·30 per cent., with an occasional 0·31 per cent., but with a slight decrease in acidity at three hours from drying. At grading these cheese appeared to be about right for acid, and were generally closer than previously, some being placed in the "finest" class. London reports on these cheese indicated that some were carrying quite enough acid, and the remainder about right.

The average factory test for October was 3·91 per cent., vat tests ranging from 3·8 per cent. to 4·3 per cent., and cooking temperatures 98° and 99°. At the commencement salt was applied at the rate of 2·7 lb. to 1,000 lb. milk, on a 4 per cent. fat basis, but was increased later to 3 lb., as the earlier cheese were considered a little light in salt. Generally speaking, good "shotty" cooks were obtained during the month, and little variation was made in methods of running and drying, whey being run at from 0·18 per cent. to 0·19 per cent. acidity, tap shut when a depth of 7 in. was reached, curds stirred in this amount for about seven minutes, tap opened full when desired acidity was reached, and remainder of whey drained from curd as rapidly as possible, with either two or three dry stirs. It was found that running off the vats in this way gave very uniform drying figures, it being possible to dry from day to day within 0·025 per cent. of the figure desired.

The starter used was one that had been operating in the factory previously, and so far as acidity, development, body, and flavour were concerned was quite satisfactory. Around 1 per cent. was used, with a ripening period after vats were filled of about fifteen to twenty minutes. Every vat was tested on acidimeter and by the Marschall rennet test as soon as filled and again before setting, the rate and amount of development being taken as the guide to setting rather than the initial figures. It may be mentioned that this method was in use throughout the season and served as a very useful guide relative to when vats should be set.

In the first month even with rigidly controlled manufacture slit-openness was evident, but was not quite so pronounced at the higher-drying acidities. However, it was later indicated that the cheese would not carry this higher acid satisfactorily, the limits of safety apparently having been reached.

Two other starters had been used for short periods during the month, but as they did not give satisfactory workings their use was not continued.

Vitality tests of starters were frequently made, and proved of great value in determining the acid-producing properties of each starter tried. As a rule, either three or four cultures were being carried, and tests were made at intervals of a week or less. The opinion is ventured that if more use were made of this test and "spare" cultures carried fewer cases would be reported of starter troubles and failures.

Milk quality during October was of a fairy high standard, second grade amounting to only 2 per cent., and this mostly in the early part of the month. Weather generally was cool, and, with the exception of one sample decolourizing in twenty minutes, milks "stood up" well above the two-hour standard on the reductase test. The remainder of the milk graded into second was for unsound flavour on the curd test, the cause of which was found to be insufficient care in the cleansing of the milking plants.

November.—During the first period of November acidity at drying was around 0·31 per cent. and 0·32 per cent., with 0·94 per cent. to 1·0 per cent. at three hours from drying, and an increase of about 0·05 per cent. at three hours and a half to three hours and three-quarters, when salt was usually applied. Most of these cheese were considered

to be right for acid at grading and some were "finest," but many showed a fair amount of slittiness. The same procedure was adopted during running off as in October, but a certain amount of chippiness became evident during cheddaring and after milling. This was not definitely accounted for, but was presumed to have been caused, in part at least, by high acid at running and drying. Cooks were good, but it was noticed that curds had a tendency to "come back" a little soft before milling.

However, curds that were chippy did not necessarily produce cheese that were more slitty than normal curds, nor did those that had "come back" soft. Following a reduction in acidity at drying to around 0·29 per cent., but with no corresponding reduction at three hours from drying, this chippiness became less evident, and curds were more pleasing to handle, but slittiness was not reduced.

November factory test averaged 4·09 per cent., vat tests ranging from 4 per cent. to 4·4 per cent., and salt was applied at the rate of 3 lb. for 4 per cent. milk, while cooking temperatures were 98° and 99°.

Three starters were used, one being made up from a Hansen powder culture at the factory, another obtained from Cardiff, Taranaki, and the other was a Wairarapa culture forwarded by Dr. Moir. All worked well, but the Wairarapa and Hansen were not used for long, both having unnatural flavours. The Cardiff starter was clean in flavour and continuously active, but slit-openness was present in cheese made from each starter to about the same extent.

On the 21st and 22nd one vat was made from unpasteurized milk, and good curds resulted. At the time of making it was thought that a little more acid might improve the quality, but London reports indicated that these cheese were more normal in acid than most others at the time. Rather warmer weather was being experienced at this period, and as there were quite a number of samples on the curd test showing flavours no more unpasteurized cheese were made until early in December.

A summary of the month's work indicated that cheese made with three different starters were equally slitty. Dry, chippy curds did not appear to have any effect on slittiness, nor did curds which were both "acid full" and normal. Both vats made from unpasteurized milk were showing slit-openness at London, but not quite to the same extent as the pasteurized.

Milk quality showed some improvement over the previous month, there being only 0·9 per cent. second grade, all on the curd test. Although the weather was becoming milder, the great majority of samples "stood up" on the reductase test for four hours and over, only an occasional sample decolourizing around two hours.

November climatic conditions were quite favourable for milk-production, with a plentiful supply of green feed throughout the district.

December.—Early in December further experiments with unpasteurized cheese were carried out, and some trials made with equally divided milks—pasteurized and unpasteurized. The weather was fairly cool at this time, and good flavours were obtained. Drying acidity was around 0·29 per cent., which later proved to be ample. On the fourth day several loaf cheese were made from each vat and matured at the

factory. Upon being cut at five months, it was found that the unpasteurized was the superior cheese, having a nice clean cheesy flavour, whilst the pasteurized, although clean, was inclined to be a little neutral. Both cheese were fairly close, showing just a few small slits.

From the 5th to the 9th all unpasteurized-milk cheese were made, drying acidity being lowered to 0·27 per cent. on the 7th. At grading and at London, the 5th and 6th days' make were rather strong in flavour and acid full, whilst the 7th and 8th (lower acidity) were "finest" on both occasions. Unfortunately, the night of the 8th was very warm, with the result that flavours on the 9th were anything but pleasing, and the vats travelled rather too fast. This change was observed both at Auckland and London, it being worthy of note that, whereas the 8th day's make graded 93½ points, the 9th's was worth only 91½.

As there was such a marked difference in closeness between the 6th and 8th days' make it was arranged with Dr. Moir to make a full analysis of the two cheese. From the result of the analysis Dr. Moir found that the chief difference was in the salt to calcium ratio, which may have been a factor affecting closeness, but the limited experience does not justify definite conclusions.

From the tenth day pasteurization was reverted to, the spell of hot weather continuing to near Christmas. Practically the same drying acidities were observed during the remainder of the month, and for a period good results, with nice curds and smooth-bodied, close cheese, grading 93½ points, were obtained.

During the last period of the month, however, slit-openness again became evident in some cheese, but this could not be accounted for, because, to all appearances, curds that resulted in close cheese were no different from those that gave less satisfactory results. The Auckland graders consistently remarked on nice body and acid of both the close and slitty cheese, whilst London reports in these respect were also very favourable. Slittiness, however, was not so evident when these cheese were examined at Home as when the cheese were graded here in New Zealand.

Only two starters were used during the month, the Cardiff being replaced by Hansen No. 2, made at the factory. This starter was used from the sixth day, and it will be noted that, although all the "finest" cheese were made with it, some slitty cheese also resulted.

Unpasteurized-milk cheese was very satisfactory, but a notable feature was the effect of a warm change in the weather on both flavour and acid development.

Lower acidity at drying gave good results, but was apparently not entirely responsible for the disappearance of slittiness.

Besides the method of running vats off, as described previously, the "straight off" method was used for a part of the month, the procedure being to wait for the desired acidity at about two hours and three-quarters, then run the whey straight off at full tap, stirring curd in whey until vat was tipped, followed by either two or three dry stirs before piling.

During the warmer portion of the month a little trouble was encountered with faulty milk, the greater part of the 3 per cent. of second grade being in the earlier period. Warmer night temperatures also

showed their effect in the reductase test, several samples decolourizing in thirty and forty minutes, it being also generally noted that where a sample decolourized under one hour and a half an acidy condition on the curd test also followed.

Although some milks were delivered at temperatures of up to 70°, these were not necessarily the first to decolourize, indicating that other causes were operating. December average factory test was 4·16 per cent., with a range of 3·9 per cent. to 4·5 per cent. in individual vat tests, and salting was at the rate of 3 lb. for 4 per cent. milk with a 0·1 rise for each 0·1 per cent. increase in fat.

January.—January opened with cooler weather, and on the 1st all unpasteurized-milk cheese was made, but as most vats showed flavours pasteurizing was reverted to.

As rainfall at this time was below average, pastures were becoming a little dry, this being reflected in a falling milk-supply. Acidity at drying was around 0·26 per cent. to 0·27 per cent., with about 0·94 per cent. in three hours from drying, and showed normal acid at grading. Hansen No. 2 starter was still being used, and cheese graded 92½ points, slitty texture being the only defect. Several days' make in early January graded 93½ points, but, as treatment in the vats and curds was similar to that which resulted in slitty cheese, no definite reason could be given for the better results. Towards the middle of the month a change was made to a starter obtained from Dr. Moir, but these cheese were also slitty. A significant feature at this period was that, although this starter worked very similarly in acid development to the Hansen No. 2, cheese at fourteen days showed definitely less acid, and were not so "bright" in character.

Hansen No. 2 was reverted to, and the resultant cheese immediately showed improvement. This was a good illustration of "character" of starter, showing that although the other starter developed the same acidity the "nature" or "kind" of acid was different.

The cheese, although improved in character, were, however, too slitty to be placed in the "finest" class. Towards the end of January pastures were becoming fairly dry, with the result that good cooks were more difficult to obtain, and curds generally had a tendency towards mushiness or doughiness. Coagulation was normal, and cook up to a certain point was normal also, but the desired normal improvement at drying was becoming noticeably absent, with whey at drying inclined to be milky.

In an endeavour to effect an improvement, various modifications of the normal routine were tried. Firstly, acidity at drying was lowered to 0·25 per cent., curds at normal figures appearing to be carrying rather much acid, but no improvement resulted. Secondly, cooking temperatures were raised to 100° and 100½°, with the idea of expelling more moisture, this also without any appreciable effect. Higher drying acidities, up to 0·285 per cent., were then resorted to, with the idea that the high acid would have a tendency to expel moisture. These modifications were put into operation gradually, both with and without alterations in cooking temperatures, but it was found that better results were obtained with the normal routine. Additional stirring, both in the whey and on the pan, was also tried, but it was our experience that

curds were liable to be "fatty" and "ragged" without being any drier at three hours from piling. A little salt added to the curd after milling had the effect of removing most of the surplus whey, but it would have been much more pleasing to us to have been able to remove this whey during the earlier stages of manufacture.

Several laboratory casein tests indicated that the casein to fat ratio was below normal, but the impression was gained that other factors were operating against our obtaining normal results. Cheese made during this period were a little more satisfactory than anticipated, mostly grading 92 and 92½ points. Those at 92 points with 18 points for body were the lower dried, and had only about 0·85 per cent. acidity at three hours from piling.

At this period it was noticed that a number of samples on the curd test were soft in body and that such samples were not necessarily from those suppliers whose feed was the driest. Several samples were duplicated and starter added to one, and occasionally the curd with the starter added was much more mushy than the control, giving rise to the thought that some constituent forming the acid base was abnormally low in proportion. Several samples were subjected to the vitality test, but all showed normal acid development. The starter milk was fortunately giving a normal curd, and three starters, by the vitality test, proved normal.

The average factory test for January was 4·16 per cent., vat tests ranging from 4·1 per cent. to 4·5 per cent., and average rate of salting at three hours and a half to four hours was 3·1 lb. for 4 per cent. milk.

Besides Hansen No. 2 and Dr. Moir's starters, Cardiff No. 1 was also used for a short period, to note effect on curds, results being similar with each starter.

Methods of running off in January consisted of "straight off" run to 7 in., and also running whey down to 12 in. at two hours from setting, replacing agitators, and running off finally at approximately 0·02 per cent. higher than with the "straight off" method. This method ensured good control of drying figures, but results were generally similar with each method.

Milk quality showed a falling off in January, and 5 per cent. was second grade. Feed flavours accounted for a portion of the increase, but defects in body were the most serious faults.

February.—Early February conditions were very similar to those of late January, whey being milky at drying, and about 0·3 per cent. salt was applied after milling. Acidity at drying was around 0·27 per cent., with about 0·90 per cent. to 0·96 per cent. at three hours. These cheese were carrying quite enough acid at grading, and were slitty in texture.

Another culture from Cardiff was received, and was used after about a week's propagation. This culture had been made up from a Hansen powder, and was giving very good results at the factory whence it originated. Our experience was, however, that very good results in the vats were not followed by a reduction in slittiness.

It was thought that in addition to the shortage of casein in the milk there might be some deficiency in minerals, and trials with the addition of these, which will be referred to later, were carried out. In the meantime a preliminary experiment, in which calcium chloride was

added in small quantities to one vat, was carried out, but no definite improvement was noted. The amount added was 0·025 per cent., but this was greatly increased in a later experiment.

About the middle of the month beneficial rain fell, and an almost immediate improvement in the condition of the curds was noted. This condition arose frequently during the autumn months, it being remarkable in view of the fact that the improvement often preceded any freshening of pastures. However, on this occasion the improvement was maintained to the end of the month, and, although openness did not entirely disappear, grades increased from as low as 91 to 92½ points, several lines at the latter score being awarded 19 points for body. A further Hansen powder (Hansen No. 3) had been propagated at the factory, and gave, apart from the slitty texture, good results.

The average factory test for February increased to 4·37 per cent., with a vat test range of 4·2 per cent. to 4·8 per cent., cooking temperatures being 99½° to 101°. Owing to the fact that mid-February cheese were showing plenty of acid at grading, the drying standard was reduced to 0·25 per cent., resulting in more pleasing acidities of the cheese.

Methods of running off consisted of the "straight off" and run to 12 in. at two hours methods, both, as previously, giving similar results.

As pastures generally were dry, supplementary feeding was resorted to by most suppliers, this consisting of turnips, lucerne, ensilage, maize, millet, &c., with the result that a number of vats showed feed flavours at grading. The milks responsible for these flavours were, however, easily determined on the curd test, and accounted for a fair proportion of the second grade awarded in milk-grading. Frequent casein testing indicated a low ratio of casein to fat, but this became practically normal after the rains.

In addition to the feed flavours referred to above, body defects in the earlier part of the month were responsible for a large portion of the 7 per cent. of second-grade milk received. Milk temperatures were satisfactory, practically all night milk being 65° or under. In the reductase test only five samples from a total of 420 taken decolourized under two hours, so that, according to this test alone, our February milk was of a high standard. From a cheesemaking viewpoint this was certainly not the case.

March.—Early March cheese were quite satisfactory, and were a little closer in texture, being awarded 18½ points for closeness, as against mostly 18 in February. Hansen No. 3 starter was still being used, curds being piled or dried at around 0·25 per cent. and 0·26 per cent. acidity. Curds generally were cooking well, but would not stand too much dry stirring, having a tendency towards raggedness. However, upon a change being made to a South Island starter obtained from Dr. Moir, a much brighter curd resulted, it being firm and smooth and breaking down nicely at three hours from drying. A feature of this starter was that although acid development in the whey was not very rapid, and the drying figure was no higher than previously, a higher figure at three hours was obtained, showing an increase of around 0·07 per cent. acidity. This had also been indicated in the vitality test. Although more pleasing curds resulted from the use of this starter, openness was

not reduced, and a starter that had been very successfully operated at Lepperton, Taranaki, was given a trial. Results for a period of about seven days were very pleasing, cheese grading 93½ points.

Unfortunately, however, dry weather conditions were again being experienced, with the result that the relationship between acid and cook was disturbed, and the grade fell to 92½ points, slitty and open texture being the defect.

During the latter part of the month a short trial had been made with a starter obtained indirectly from Opouriao, Bay of Plenty, where consistently close cheese were being made, but as this culture showed some contamination it was discarded.

Milk-supply at the end of March was declining rapidly, this being reflected in the higher butterfat content, the average test for the month being 4·63 per cent., with a range of 4·6 per cent. to 5·1 per cent. in vat tests. Casein tests indicated a low ratio during the drier portions of the month, and cooking temperatures ranged from 100° to 101½°, it being deemed inadvisable to exceed the higher figure. Results showed that cooks were no more pleasing at the higher temperatures than at the normal standard.

Milk quality showed some improvement in March, second grade being just under 4 per cent., practically all of which was by the curd test. Only four samples decolourized in less than two hours under the reductase test—three of these were second grade under the curd test.

April.—April was a dry month. As in part of March, difficulty was experienced in obtaining the type of curds desired, and a fairly large proportion of the samples on the curd test were showing the effects of the climatic conditions prevailing. Acidity at drying with the "straight off" method was around 0·26 per cent. and 0·27 per cent., which proved, with 0·85 per cent. at three hours, quite enough acid.

Early in the month another culture, direct from Opouriao, was used, and, apart from the slitty texture, gave good results. At this time an experiment consisting of holding some cheese from each vat for three days in the press was carried out with a vew to ascertaining if longer pressure would have a tendency towards reducing slitty texture. All the cheese from the vat were placed in the press as usual overnight, and next day three cheese, in the hoops, were removed to another press. Each succeeding day pressure was relaxed, the outside section of each hoop removed, lubricated, replaced, and pressure again applied. Results of this trial were disappointing, as the longer pressed cheese were as slitty as those held for the usual period.

A further experiment to test the effect of pressure upon the reduction of slittiness was the placing of cheese in Canadian-type boxes. Each box was made to fit a cheese fairly closely, and was similar in shape to an ordinary hat box, the height being so adjusted as to cause each cheese to project slightly above the side of the box. The cheese were placed in cool storage, stacked five high, and changed weekly, with the result that the cheese received almost continuous pressure. The value of this experiment will be ascertained at the end of three months storage.

An experiment with clarified milk was also carried out during the month, and will be referred to later.

Towards the end of April, when the lactation period was becoming well advanced, curds were rather greasy and "wintry" in character, with the result that lower acidities at drying had to be observed. Although slit-openness was noticeably less in the cheese at this period, bodies and general character were, as expected, not of a very high standard, and no cheese were placed "finest." During the last period of the month the whey was run to 12 in. at two hours and agitators replaced, this method, especially with a full vat containing about fourteen cheese, giving results that were more satisfactory than with the "straight off" method.

The average test for April was 5 per cent., and vat tests ranged from 4·8 to 5·7 per cent., with a general casein to fat ratio of around 0·47 to 0·51, the maximum cooking temperature being 101½°. Average salting was 3·15 lb. for 4 per cent. milk with a 0·1 rise in salt for each 0·1 per cent. fat increase. Throughout the season this standard was not rigidly adhered to, variations being made according to the character of the curd and other existing conditions.

April milk quality with 0·2 per cent. second grade was very fair, though quite a number of samples were just passable first grade for body, whilst only three samples from a total of 450 decolourized under two hours on the reductase test.

May.—As the milk-supply had very much diminished, control was relinquished on the 11th, when the factory ceased receiving milk daily. As in the latter part of April, curds were not very pleasing in character, cheese grading mostly 92 points, mechanical openness being more pronounced, whilst very little slittiness was evident.

During the last week of control a starter from Wyndham, South Island, forwarded by Dr. Moir, was used, but conditions were not such as to enable any definite opinion to be formed as to its value with relation to slit-openness.

Early in the month an additional trial in connection with longer pressing was made. In addition to the steps taken previously, the cheese were removed from the hoop completely and reversed end for end daily. It is worthy of note that each cheese so treated lost at least ½ in. in height whilst in the press for the three-day period, but examination of the cheese at grading did not indicate any marked reduction in openness. It is possible, however, that results may have been more satisfactory if normal cheese had been tried during the warmer weather.

Vat tests during the period ranged from 5·3 per cent. to 5·8 per cent., and casein to fat ratios were around 0·5. Weather was cold, with very little second-grade milk received, and practically all samples "stood up" on the reductase test for over seven hours. As in April, a number of samples on the curd test were passable first grade only for body, and the only second grades awarded were for this defect.

Experiments.

Added Minerals.—During February a trial extending over fourteen days was made, in two 100-gallon vats, with the addition of various minerals. As it is to date not possible for research chemists to state

definitely in just what proportion the various mineral salts are present in normal milk, the experiment had to be more along the lines of a "shot in the dark" than would have been the case if there had been some definite basis to work on. The minerals used were magnesium chloride, calcium chloride, citric acid combined with sodium citrate, acid sodium phosphate, and sodium citrate combined with hydrochloric acid. All were added in varied amounts, with various acidities at drying, and strict controls were used. These cheese were examined at fifteen days, one month, and three months from date of manufacture. The control cheese in each case was either equal to or better than the cheese with the minerals added. This would apply both to body and texture, whilst in a few cases a slight chemical flavour was noticeable in the experimental cheese.

Clarification. — With a view to ascertaining what effect the removal of mammitis pus cells, in part, would have upon cheese of quality, an experiment over a period of ten days was carried out in April. As it was not possible to obtain a proper clarifier, a 660-gallon Titan separator was used, separation being practically eliminated by means of several $\frac{1}{4}$ in. holes drilled in the top disk cover about 2 in. below the ordinary cream outlet, which was blocked. This machine served the purpose fairly well, though a small amount of separation did take place at the disk spindle. This was flushed out with a small quantity of hot water, the same amount being added directly to the control vat. The two 100-gallon vats were used, and special care was taken to have exactly the same milk in both vats. Examination of samples of clarified and unclarified milk showed, in every case, a marked reduction in pus cells and numbers of bacteria following clarification; but, although it was noted on several days that the curd from the clarified milk was a little more pleasing than the control, no difference, either in body or texture, could be found either at fifteen days or six weeks from date of manufacture, all cheese showing a fair amount of slit-openness. All milk was pasteurized before being clarified, it not being convenient, with the facilities available, to clarify before pasteurization.

Heavy Cheese Bandage.—During December and January some trials were made with cheese bandages of different weights and strengths, to note the effect, if any, upon closeness. Four types, going by the numbers 25, 50, 60, and 70, apart from the ordinary bandage, were used, and none were waxed. Cheese in all of the heavy types settled down only very slightly as compared with those in the ordinary type, and several crates were held in storage for examination at maturity. An examination recently made indicated that the cheese in No. 25 were closer than the others, which were all similar in openness. It is intended to cut all cheese at an early date, when definite conclusions will be arrived at.

Summary.

All cheese forwarded for grading to Auckland were tested for fat, moisture, and salt, an average of the results being—fat 36·36 per cent., moisture 34·11 per cent., other solids 29·52 per cent., fat in W.F.S. 55·18 per cent., salt 1·51 per cent., salt in brine 4·6027 per cent.

The average cheese grade was 92·232 points, with 11 per cent. "finest." No second-grade cheese was manufactured.

Milk-grading Tests.—From our experience at Rukuhia, comparisons made between the reductase and curd tests indicate quite definitely that the curd test is of infinitely greater value as a means of grading milk for cheesemaking than the reductase test. This does not necessarily mean a condemnation of the latter, which served quite a useful part in the determination of the quality of the milk received.

With regard to the comparative value of the rennet and titration tests as a guide to setting, the conclusion from the season's work is that, although both methods were of real help, the evidence would be in favour of the titration test, more especially for pasteurized milk. It is desired to emphasize the fact that the rate and amount of development must be taken as the guide in both tests, otherwise their value would be greatly diminished.

The experience at Rukuhia with unpasteurized milk for cheesemaking showed that, providing the milk was of very sound quality, very satisfactory results could be obtained, but that changes in climatic conditions had a very marked effect on cheese quality.

Starters.—It was found on several occasions when changing to a different starter that, although the same setting, drying, and three-hour acidities were obtained, resultant cheese at fourteen days were not similar in acidity or body. This was proved, by reverting for a day or so to the starter previously used, to be a characteristic feature of that starter, and not to other conditions. It was also noted that a change in starter would sometimes, even at same drying figure, cause the whey at drying to taste more acid, a significant feature being that these cheese would generally show a little more acid at grading. This confirms the opinion that type or "kind" of acidity varies largely between different starters.

Rainfall.—Lack of rainfall in the autumn months undoubtedly had a very large bearing on cheese quality, especially with regard to "body," but did not appear to cause any increase in slittiness as compared with the more favourable spring months. As the Hamilton rainfall from the 1st January to the 30th April totalled only 9·56 in., against a yearly average for that period of 14·09 in., it may be realized easily, especially with Rukuhia district's light soil, what effect there would be on milk-supply and cheese quality. Apart from Gisborne, with 8·78 in. of rain, Hamilton recorded the lowest rainfall for the North Island for this period.

Rainfall from October to April was also below average, being 5 in. less than in the previous season.

Home Reports.—Up to date of writing, reports from the Department's London officers, covering practically every vat to early January make, have been received, and in the main have been very satisfactory. A portion of October and November cheese was carrying quite enough acid, but, generally speaking, slit-openness does not appear to be quite so evident at the London end as was the case when the cheese were graded in New Zealand.

Taking the whole experiment generally, the greatest trouble encountered was slit-openness, and, apart from this, no difficulty in producing a sound commercial-quality cheese was experienced. Neither

sound manufacturing methods nor various modifications, as detailed previously, appeared to have any permanent diminishing effect on slittiness. None of the many starters, although active, and according to bacteriological examination comparatively pure, had the effect of producing consistently close cheese. In this connection it is worthy of note that in a number of instances where factories in neighbouring districts obtained cultures from Rukuhia, and adopted manufacturing methods very similar to our own, no trouble was experienced in obtaining cheese free from slittiness. A more concrete example was that during the season two Taranaki factories, one using the same starter as was in use at Rukuhia, were asked to carry out for a period their manufacturing operations on exactly the same lines as we had adopted, with the result that all cheese made by them under these conditions graded either $93\frac{1}{2}$ or 94, the Rukuhia grade being $92\frac{1}{2}$, with slitty texture.

A survey of the experiment leads to the conviction that some unknown factors had a marked bearing on slit-openness and other problems, and emphasizes the necessity for further research in an endeavour to throw more light upon milk and its constituents and products.

THANKS.

The writer's thanks are due to the following, and all others, whose willing help and co-operation were largely responsible for the smooth running of the experiment: The executive officers of the New Zealand Co-operative Dairy Co., Mr. W. H. Udy, Mr. A. Milne, Mr. A. Laurent and his factory staff, the Rukuhia suppliers, the Auckland grading and testing staff, Dr. Moir, Mr. C. Stevenson, Mr. Kidd; and especially to Mr. A. McKenzie, whose advice and guidance were very much appreciated.

WAIMATE WEST DEMONSTRATION FARM.

REVIEW OF THE OPERATIONS, 1933–34 SEASON.

J. M. SMITH, Instructor in Agriculture, New Plymouth.

FOR the second year in succession we were favoured with wonderful weather conditions, and this has been a large factor in the very successful season that must be recorded. It will be remembered that the autumn of the 1931–32 season was one of outstandingly dry conditions, and as a result all reserves of fodder were depleted. The 1932–33 season was a good one from a weather point of view, and much leeway was made up. The season just concluded was, if anything, better than the 1932–33 season. The district in which the Waimate West Farm is situated is one where normally the spring is early and generally favourable. The summer and autumn, however, frequently give farmers cause for concern, as these seasons of the year are likely to be extremely dry. During the year just past the spring-like conditions prevailed right throughout the summer and autumn, with the result that pasture growth was good and the feed problems gave farmers no cause for concern. The general policy of increasing fodder reserves was continued, and a large carry-over

of hay and ensilage was made. With the increased stocking this season the probable carry-over of fodder will not be so great, but there is still sufficient to ensure the stock being well maintained should anything unforeseen occur.

The Objective.

A fact often lost sight of by the general farming public is that farms such as the Waimate West Farm are firstly farms for the carrying-out of experimental work and for demonstrating those methods and operations which experimental work has proved sound. This should be, and is, their first objective, but the fact is often lost sight of that to carry out this objective a sacrifice in financial returns may have to be made. As the farm has no endowments or financial vote, the matter of finance gives the committee much concern at times, for if no financial assistance is forthcoming the committee must consider ways and means of making the farm pay its way (as it has done this year), and consequently experimental work must suffer and the real objective of the farm is lost. It is with the knowledge that experimental work is costly that the Department of Agriculture gives an annual subsidy to the farm, but through force of circumstances this subsidy has been greatly reduced until it is not big enough to warrant the undertaking of any extensive experimental work. During the past few seasons much experimental work has been allowed to lapse and the committee has concentrated on the farm's finances, with the result that this season these are in a very healthy condition. There is no doubt that this farm could be run as a model up-to-date dairy-farm on sound commercial lines were this warranted, but to-day in Taranaki there are such farms in every district. What is really required is a farm giving the whole of its attention to various experiments which take one into the more or less unknown. To do this revenue must be assured. However, even in view of making revenue the first consideration, it has been found possible to carry along several standard experiments and to put down new trials.

Experimental Work.

As very little cropping is done, it follows naturally that the experiments are, in the main, in connection with pasture problems. Top-dressing naturally occupies a prominent position in pasture work, and in one field there is one series of plots top-dressed with various standard phosphatic manures. This trial is only in its second season, so that nothing very definite has yet been demonstrated, except that phosphatic manuring must be persevered with even in these times of stress. The pasture strips where no manure has been used in this paddock indicate a rapid reversion to an inferior sward. There are indications that potash may be deficient in these soils, and to determine this definitely two series of potash plots have been put down. In these potash is used alone and in conjunction with both lime and phosphate, while on one plot the whole three are in combination. This, by the way, is one of a series of some 150 plots being put down in Taranaki to determine the potash response belts in this province.

The matter of better strains of grasses and clovers is being given consideration. Already the great superiority of certified perennial rye has been demonstrated, while a series of clovers was sown down last spring.

It is recognized the world over that our New Zealand white clovers are the finest ones obtainable. Any English seed catalogue will recommend New Zealand white clover in the grass mixtures. Within our white clovers, however, we have strain variations practically as great as is the case in the ryes, and these strain differences will have just as great an effect on our production as did the rye-grasses. Although these plots have been down only a few months, the New Zealand No. 1 is showing up favourably against the others, which, by the way, include the famous Kentish Wild White.

The paspalum area promises to become well established. In its second year the paspalum was prominent in the autumn, and, given a dry autumn, it will probably come up to the expectations of its champions. This autumn being so spring-like, the rye-grasses continued to grow strongly right through the autumn, and consequently the paspalum did not show to advantage. The subterranean clover also gives much feed prior to and subsequent to the drier months.

The area sown with prairie grass did not come up to expectations. The strike was not good, and subsequent feedings had the effect of thinning out the stand still further. Notwithstanding this, in some of our older pastures there is much prairie grass, which gives a considerable amount of feed in the winter and early spring.

Cropping.

As a rule very little cropping is done, but this season, in the preparation of a seed-bed for lucerne, some 4 acres were in crop. Two acres of rape were sown and grazed by the cows in the autumn, and it is interesting to record that no second-grade milk was delivered. The cows were given half an hour immediately after milking and then removed, and there is no doubt that with judicious feeding dangers of taint can be eliminated. Rape is a crop that is grown widely for cow-feed in some districts, and there seems to be no reason why it should not be included in our lists of autumn crops provided the feeding is carried out in a common-sense manner. The remaining 2 acres were in soft turnips, swedes, and chou moellier, all of which were fed out in the late summer and autumn without any trouble to either stock or milk. Half an acre of carrots and mangels for wintering the pigs gave a good crop.

In regard to cropping, the question arises as to whether it would not be a payable proposition to always have 4 acres or 5 acres of crop to carry an increased herd, but one of the factors militating against cropping at this farm is the weed problem. The early history of the farm reveals consistent grain-cropping with subsequent grazing abuse following self-sown pastures of doubtful quality, and wherever the plough is used weeds come up literally in millions, and these, particularly the fumitory, smother seedling plants.

Hay and Silage.

Forty acres out of the 90 acres comprising the farm were cut for hay and ensilage, about equal proportions of each on an acreage basis being made. The concrete-tub silo was partly filled with grass instead of wholly with lucerne as previously. It will be recalled that previous seasons have resulted in much waste round the walls, and it was thought that perhaps with grass this waste might not occur. The waste, however, is practically as great as in previous years, and it is felt that the silo with thin walls will never be a success with long material. The quality of the hay saved this year was good.

Lucerne.

The 4 acres which were resown are establishing satisfactorily, although the stands are not as good as those usually obtained after lea. The other 4 acres were cropped as indicated and will be resown with lucerne this spring. There is no doubt that in this district no dairy-farm should be without about 10 per cent. of lucerne on an acreage basis. With the chance of every season having a dry autumn, there is no finer insurance against drought than a good stand of lucerne. Even though grass encroachment may mean that the life of the stand may be only eight or ten years, even this period of useful lucerne will repay handsomely.

Top-dressing.

The whole of the pasture land exclusive of that used for top-dressing trials has been top-dressed with 3 cwt. per acre of phosphate (super and basic super). On those farms where production is high no farmer can afford to neglect top-dressing, and the better the production the more important the top-dressing becomes. A farm producing 100 lb. of butterfat per acre might, without manure, drop by 20 lb. or 30 lb., but a farm producing 200 lb. of butterfat per acre might drop 80 lb. to 100 lb. without manure. While the seasonal conditions doubtless have been a big factor in the increased production, there is little doubt that the policy of continuing the standard rate of top-dressing has also had a bearing on it.

Pasture Harrowing.

This work has been well maintained, and there is no doubt that at certain times of the year much harrowing is very desirable. If droppings are left undisturbed they do more harm than good to the pasture sward.

Herd.

The herd milked during the season was sixty-one in number, as against fifty-seven in the previous season. As usual, unfortunately, "empty" cows and "slips" were included in this total of sixty-one. The total butterfat for the season (factory returns) of 18,968 lb. creates a new record for the farm, the previous best being 16,639 lb. last season. On a cow and acreage basis this season's production worked out at 311 lb. per cow and 210 lb. per acre, as against 290 lb. per cow and 185 lb. per acre last season. The quantities of fat, in pounds, produced month by month for this season are as follows: July, 217·5; August, 1,268; September, 2,283·8; October,

2,625; November, 2,439·4; December, 2,192·2; January, 2,200·1; February, 1,747·9; March, 1,783·2; April, 1,336; May, 681·5; June, 194·1.

The total butterfat and the production per acre, in pounds, over the last five years are as follows:—

Year.	Total Fat.	Per Acre.
1929–30	13,458	149
1930–31	15,636	173
1931–32	15,982	177
1932–33	16,639	185
1933–34	18,968	210

Pigs.

During the past season these have been a profitable side-line. Five sows have been kept and the progeny sold either as weaners, porkers, or baconers according to the market and food-supply. Fifty-five pigs were disposed of, netting £79.

Stock-carrying.

A survey of the stock carried will indicate that this is fairly high, but given normal seasons and the usual carry-over of fodder-supplies the margin of safety is fairly good. Naturally a long period of adverse conditions would create a feed shortage, in which case some of the stock would have to be sacrificed; but with the chances of such a season being less than one in ten it would not be good farm practice to reduce the stock to a margin of safety to meet such exceptional conditions. The present stock carried on the 90 acres is as follows: 59 cows, 6 in-calf heifers, 14 yearling heifers, 2 bulls, 3 horses, 4 sows, and 1 boar.

Working-costs.

The statement of accounts and balance-sheet discloses a year of strict economy in every possible direction, and, considering the times, the result is highly satisfactory.

The Live-stock Account closes with a credit balance of £143 6s. 9d. Stock on hand at the beginning of the season was valued at £876 10s., while there were no purchases during the season. Stock on hand at the end of the year stand at £896, while sales of stock (pigs, calves, and cull cows) realized £124 6s. 9d.

A credit balance of £164 3s. 1d. in the Working Account indicates the attention that has been given to the farm expenditure. The total expenditure totals £588 11s., while milk sales produced £752 14s. 1d. The main items of expenditure are wages £272, manures £63, seeds and feed £10, rent £90, power £29, rates £25, testing £12, interest £69.

The Profit and Loss Account shows a credit balance of £212 14s. 11d. on the year's working, and this after allowing £110 16s. for depreciation on buildings and plant. General charges shown,

including secretary's salary, office expenses, printing and advertising, audit fees, insurance, depreciation, entertaining charges, and bank charges total £145 4s. 11d., while the Working Account credit (£164 3s. 1d.), the Stock Account credit (£143 16s. 9d.), and the Government subsidy (£50) leave £212 14s. 11d. to be transferred to the General Fund Account.

This report would not be complete without some reference to the splendid service given by the Manager (Mr. A. G. Paterson) and farm staff. In the face of wage-reductions and a policy of rigid economy in expenditure the farm has been kept in first-class order and the farm work faithfully carried out.

PASTURE TOP-DRESSING ON WEST COAST, SOUTH ISLAND, OF NEW ZEALAND.

EXPERIMENTAL WORK BY FIELDS DIVISION, PERIOD 1930–34.

R. McGILLIVRAY, Fields Superintendent, Christchurch, and J. STEVENSON, Fields Instructor, Greymouth.

THE West Coast Instruction District consists of Westland and that portion of Nelson contained within the Buller, Inangahua, and Murchison Counties. The total area of the district is 10,300 square miles. There are approximately 2,293 holdings in the district, and the average size of the holding is 554 acres. Grassland farming is the only type of agriculture of any moment there. Dairying, fat-cattle production, and sheep-farming are carried on, and where pastures have been improved the carrying-capacity and general production is satisfactory.

The climate of the West Coast is influenced by its position on the western side of the high dividing-range and the prevailing wind from a westerly direction. The rainfall is high, ranging from 80 in. to 100 in. per annum; but records show that the hours of sunshine experienced are high, and the district is noted for its clear atmosphere during fair weather periods. Much of the present farming land was at one time in bush and scrub. The greater part of the settlement is on river-flats and on areas of more or less open country such as the Wataroa, Harihari, and Totara Flat districts. Some top-dressing of pastures in the district was first undertaken by farmers many years ago. The Department of Agriculture laid down some trials about fourteen years ago, but it was not until 1930 that a systematic plan of top-dressing experiments in various parts of the district was inaugurated. In these experiments lime, superphosphate, potash, and nitrogen were used in the first series, but in the later trials nitrogen was omitted.

Considerable interest has been shown by farmers in the question of pasture management and the general utilization of the pasture growth. The making of ensilage is now a recognized farm practice, and the utilizing of the excess growth in this way has greatly improved pastures, and has given a clearer indication of the response received from suitable fertilizer applications. In the manurial survey of the district the plots were treated as follows: (1) carbonate of

lime, 1 ton per acre; (2) superphosphate, 3 cwt. per acre; (3) 30-per-cent. potash salts, 2 cwt. per acre; (4) sulphate of ammonia, 1 cwt. per acre. In the first series of plots the initial dressing of lime was not supplemented, but the later series of plots received an annual dressing at the rate of 5 cwt. per acre. Superphosphate and potash salts, after the initial dressings, were applied annually at the rate of 2 cwt. per acre. Sulphate of ammonia is not now used. Very few of the plots were fenced in, and were subjected to the ordinary grazing practice of the various farms on which they were laid down.

In reporting on any group of experiments some method must be adopted to indicate the nature of the effect of the lime or fertilizers applied, and thus the following points are awarded: 0, no visible response; ?, doubtful response; 1, slight response; 2, fair response; 3, good response; 4, very good response; 5, excellent response. In some cases responses to both lime and superphosphate individually may be classed as good (3 points each), and the response to the combined lime plus super may be excellent, and 5 points awarded. The points awarded for potash and nitrogen can be regarded for practical purposes as indicating their effects over and above those of lime plus super.

In Table 1 the responses to treatment, in the various classes mentioned, are presented as percentages of the total number of trials, while in Table 2 the responses in the individual trials are shown grouped in their respective districts.

Table 1.—Percentages of Total Number of Experiments which fall in various Response Classes so far as Response to the Main Treatments are concerned.

Treatments.	Degree of Response to Treatment.							Total Number of Experiments in which Treatment used.
	None visible (0).	Doubtful (?).	Slight (1).	Fair (2).	Good (3).	Very Good (4).	Excellent (5).	
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	
Lime ..	..	..	..	..	35·0	55·0	10·0	20
Super ..	..	..	25·0	65·0	10·0	..	..	20
Lime + super	..	..	..	..	..	30·0	70·0	20
Potash ..	80·0	5·0	5·0	10·0	..	..	..	20
Nitrogen ..	..	..	10·0	90·0	..	..	..	11

General Comments on Responses to Treatments (Table 1).

Lime.—All experiments gave from good to excellent responses to lime, and clearly indicated the great need for applications of lime to the soils of the West Coast district. In two cases the response was of a most outstanding nature and quite as good as the combination of lime and super. In most cases, however, lime and super applications were better than lime alone. The experiments have clearly demonstrated the value of this combination. The use of lime has increased the clover content of the pastures, caused a better and stronger growth of grass, marked improvements in the palatability of the pastures, and on several farms has caused a definite reduction of sweet vernal, rushes, and various weeds.

The dressing of 1 ton of lime per acre has given splendid results, but the addition of an application of a small quantity annually appears to be warranted. There are ample supplies of good limestone on the West Coast, and it is encouraging to see the use that farmers are now making of this commodity, which is essential to the welfare of the primary industries of the West Coast.

Superphosphate.—Most of the responses to superphosphate fall into the slight to fair class, and it can be said that top-dressing with super on unlimed land is not a practice that can be recommended on the West Coast.

Superphosphate plus Lime.—Results from this combination have been extremely satisfactory. The responses varied from very good to excellent. The results of farmers have been similar to the results obtained on the experimental areas, and one can state that the use of lime plus superphosphate has become the standard top-dressing practice of the West Coast districts.

Potash.—In all cases 30-per-cent. postash salts were used. In 80 per cent. of the experiments there was no visible response to the treatment. Two experiments showed a fair response in the way of a more vigorous clover growth and a darker-green colour in the pasture during the late summer and early autumn. On one experiment potash definitely suppressed clover growth, and in this case the grasses present were dry and neglected by stock.

Nitrogen.—The responses to sulphate of ammonia were all slight to fair. The responses were very brief, and in all cases the after-effect on the pastures was bad. There was a distinct depression of clovers, and the sward became open and inclined to run to brown-top, Yorkshire fog, and weeds. If the responses were measured for the whole season one would be justified in recording a "no response" in the case of nitrogen applications, but the responses indicated in Table 1 refer to results over a period of a few weeks only.

Table 2.—Showing Responses on Individual Farms to Treatments.*

Farmer's Name and Address.	Lime.	Super.	Lime plus Super.	Potash.	Nitrogen.
L. Haddock, Harihari ..	4	2	5	0	2
G. Linklater, Waitaha ..	4	3	5	0	1
W. Rae, Arahura	3	2	4	0	2
Rothery and Maughan, Inchbonnie	4	2	5	0	2
W. Vallance, Rotomanu ..	3	2	4	0	2
A. Dalziel, Nelson Creek ..	3	2	4	?	2
P. Smith, Ahaura.. ..	4	2	5	2	2
W. O'Malley, Ikamatua ..	5	1	5	0	2
N. McVicar, Mawheraiti ..	4	2	5	0	2
J. Mitchell, Cronadon ..	5	1	5	0	2
W. Butterworth, Barrytown	4	2	5	0	..
R. J. Johnston, Maher's Creek	4	1	5	0	..
E. Cook, Kumara.. ..	3	2	4	2	..
J. C. Hende, Cameron's ..	4	2	5	0	..
J. Mulcare, Ngahere ..	3	3	4	1	..
Mrs. B. O'Leary, Totara Flat	4	2	5	0	..
Mrs. M. Cole, Murchison ..	4	1	5	0	..
M. E. Brown, Murchison ..	3	2	5	0	..
J. Westbrook, Longford ..	3	1	4	0	..
T. Joyce, Lake Station, Lake Rotoiti	4	2	5	0	..

* See introductory remarks for explanation of points.

Table 2 shows that the experiments reported upon cover a long stretch of country, extending from Harihari to Lake Rotoiti, near Tophouse, in the Nelson Province. The soils on which experiments were laid down embrace very light gravelly types, light to heavy loams, river silt, light beech terrace country, and mining "tailings." Manurial results, however, have not varied to any great extent, despite the great variation in the types of soil on which experiments were laid down. Liming and manurial trials were also laid down on the following farms: Dehn Bros., Wataroa, and J. Hart, Koiterangi, 1926; Leo Bell, Rotokohu, 1927; J. Butler, Matainui, 1929; A. McLennan, Waimaunga, and R. Gibbs, Maruia, 1930.

In these trials various fertilizers were used on limed and unlimed land. In all cases the value of lime application was demonstrated. On J. Hart's farm at Koiterangi, Nauru rock phosphate on the limed land showed a good response during the later stages of the trial, but during the first three years basic slag and superphosphate both gave much better results than Nauru. On A. McLennan's farm at Waimaunga, super and basic slag were both applied initially at the rate of 3 cwt. and 6 cwt. per acre, followed by annual dressings of 2 cwt. per acre. There was no appreciable advantage from the heavier initial dressings, but both superphosphate and basic slag gave results on the limed land. Basic slag, however, gave a better pasture covering, and there was a more varied mixture present in the sward. The trial on R. Gibbs's farm at Maruia showed a very decided lime response. The pasture mixture sown failed to establish on the unlimed portions, but the superphosphate plus lime plots showed quite a good pasture for the type of soil on which the area was established.

Summary.

During the 1930–31 season fourteen L.P.K.N. experiments were laid down, but for various reasons four of these had to be discarded before any reliable results could be noted. Later, ten additional plots were laid down, using lime, super, and potash treatments.

The outstanding feature of all experiments has been the marked response to lime, and to super where used on limed land. The response to super alone does not justify its use in the West Coast district. There were very few responses to potash. There was a general but fleeting response to nitrogen in the plots where it was used.

The present series of experiments and the results obtained therefrom confirm the results of the earlier departmental experiments at Wataroa, Koiterangi, Waimaunga Experimental Farm, and elsewhere. All these earlier experiments demonstrated the value of lime and the unsatisfactory results from phosphates without lime. In these earlier experiments even basic slag and Nauru phosphate gave but meagre results in growth in the absence of lime, and were in some cases entirely neglected by stock, while the same phosphates on limed land gave good results and the plots were closely grazed.

The writers wish to acknowledge the assistance rendered by farmers in placing fields at the disposal of the Department for experimental purposes and generally assisting with the laying-down of plots. Thanks are also due to the various lime companies for supplying lime free of charge, and to the Farmers' Union and Agricultural and Pastoral Associations for general assistance and co-operation in connection with the experimental plots.

YOUNG FARMERS' CLUBS.

THEIR INAUGURATION AND EXPANSION IN THE OTAGO DISTRICT.

J. E. DAVIES, Instructor in Agriculture, Dunedin.

THE great value of agricultural clubs has been well demonstrated by the success achieved during recent years by the boys' and girls' agricultural clubs, which since their inception in the Otago District in 1919 have spread throughout the Dominion. The annual report for the 1932-33 season indicated that approximately three thousand boys and girls had participated in various sections of agricultural club projects consisting of crop-growing, calf-rearing, pig-feeding, and home-science competitions.

FIG. 1. MEMBERS OF THE PALMERSTON SOUTH YOUNG FARMERS' CLUB.

The agricultural clubs developed a strong competitive element, and the majority of the members were drawn from rural primary schools, the numbers continuing after school-leaving age being comparatively small. The boys' and girls' club movement attracted strong support from juniors, but its continuance in post-school education met with little support; every endeavour was made to establish a senior division of agricultural club work, but the venture attracted only a small membership, and its extension was therefore limited.

The valuable information and experience gained from the junior boys' and girls' agricultural clubs convinced the writer that there was a keen desire among young farmers for the establishment of an organization fostering post-school agricultural education, and the development of rural social life generally. It was with this object in view that Mr. R. B. Tennent, Fields Superintendent, Dunedin, and the writer in March, 1933, inaugurated a young farmers' club scheme, whereby

in country districts local clubs would be formed, bringing together a group of young farmers between the ages of fourteen and twenty-five. Clubs were established along the lines indicated by the following brief outline relative to the constitution and operation of clubs :—

The movement is to be known as "Young Farmers' Clubs." Members are to be from fourteen to twenty-five years of age. No member under the age of seventeen to be eligible for election to a controlling committee.

The object of the club is to promote agricultural education, leadership, thrift, perseverance, self-reliance, and co-operation with authorities in agricultural education.

It is suggested that during the winter months agricultural classes, lectures, debates, &c., be arranged, and for the summer months field days, demonstrations, and visits to the Agricultural and Pastoral Shows, model farms, experimental areas, &c., be organized.

In forming a club a general meeting of young farmers from the district is convened. At this meeting the executive officers of the club are elected. They consist of a chairman to preside at club meetings, a secretary to record minutes, attend to club correspondence, &c., a treasurer to keep club accounts, and also a general committee.

All club meetings are arranged and controlled by the executive. At these meetings lectures on agricultural subjects such as stock, crops, soil, &c., or any other subject pertaining to rural conditions are a prominent part of the activity.

A person exceeding the age-limit of club membership is appointed president. His duties are to attend club meetings and assist the young chairman in the guidance, control, and development of club work generally. Club meetings are held at least monthly, and a nominal fee is levied on members to cover running-expenses. A minimum of ten members is required to form a club.

The first club formed was at Palmerston South, and the initial meeting held in March proved distinctly successful. Following this, numerous requests for the formation of clubs were received and several others were formed. In January, 1934, successful clubs were operating at the following centres :—

Centre.	Date formed.	Membership.	Number of Meetings held.	Lectures.	Debates.	Field Days.	Demonstrations.
Palmerston ..	24/2/33	24	12	14	2	2	..
Five Forks ..	18/4/33	25	5	6	..	..	2
Dunback ..	19/6/33	12	4	3	..	1	..
Milton	4/7/33	13	3	3	1	..	..
Clinton ..	27/7/33	33	5	3	2	1	3
Paretai ..	18/10/33	17	3	3	..	..	..

At the above centres a definite syllabus of instruction was adopted —viz., a series of lectures on the "Establishment and Management of Grasslands." These lectures were conducted by officers of the Department of Agriculture, and, in addition, several supplementary lectures were given by other persons interested. The season's work culminated in a combined field-day and demonstrations.

Successful field-days, demonstrations, and programmes of winter lectures and debates, &c., have already illustrated the valuable work

which these clubs may be expected to accomplish. A properly constituted organization for the fullest development of the scheme has been established. A general meeting was convened at Dunedin in February, 1934. It was attended by representatives of existing district clubs, Department of Agriculture, Farmers' Union, and other allied organizations. At this meeting the New Zealand Federation of Young Farmers' Clubs (Incorporated) was constituted, following which a general council and provincial executives were elected. The personnel of the federation is: Grand Patron, His Excellency the Right Hon. Lord Bledisloe, P.C., G.C.M.G., K.B.E., D.Sc.; President, A. C. Cameron; Vice President, R. B. Tennent, Director, Fields Division, Department of Agriculture; General Secretary, S. D. Blomfield, Public Trust Buildings, Dunedin.

To the federation is given the responsibility of directing the movement on a national basis, and at time of writing marked

FIG. 2. PALMERSTON SOUTH YOUNG FARMERS' CLUB HOLD A STOCK DEMONSTRATION AT BUSHEY PARK.

progress has been made. Apart from several additional clubs being formed in the Otago District, provincial executives and clubs are now operating in both Southland and Canterbury and probably at the end of the present year a chain of clubs will be operating throughout the South Island.

In other countries the young farmers' club movement has reached considerable dimensions. The National Federation of Young Farmers' Clubs in Britain is now a movement of significance, and recent information reveals that in January, 1934, some 188 clubs were operating in England and Wales, and these has a membership of approximately four thousand boys and girls. The movement has also assumed importance in America, Canada, and Denmark, and it is anticipated that the movement will attain a similar degree of success and importance among the young farmers of this Dominion. The movement aims at becoming self-supporting; this, however, will take some time.

IMPORTATION OF FERTILIZERS IN 1933–34.

THE following particulars of the importation of fertilizers into New Zealand for the year ended 31st March, 1934, are compiled by the Inspector of Fertilizers, Chemistry Section, Department of Agriculture, Wellington, from returns furnished by courtesy of the Comptroller of Customs.

TABLE 1.—SUMMARY OF FERTILIZER IMPORTATIONS, 1933–34 AND 1932–33.

Fertilizer.	Quantity.	
	Year 1933–34.	Year 1932–33
	Tons.	Tons.
Bonedust and bone-char	..	30*
Basic slag	14,982	42,022
Seychelles soft phosphate†	22,618	10,032
Nauru and Ocean Islands phosphate ..	147,230	188,388
Island phosphate (other)‡	12,485	16,025
Egyptian phosphate	350	160
Phosphate (not otherwise specified)§ ..	5,437	6,024
Kainit	770	785
Muriate of potash	164	155
Sulphate of potash	618	682
Potash salts (other)	2,279	2,522
Sulphate of ammonia	2,813	6,840
Nitrate of soda	749	1,862
Cyanamide	..	5
Fertilizers unspecified	28	51
Totals	210,523	275,583

* Bone-char. Madagascar. see Table 3). and re-exported.

† Includes phosphates from Seychelles Island and islands in the vicinity of
‡ Includes phosphate from Tuamotu Archipelago and New Caledonia (for details
§ Chiefly from Belgium—presumably North African phosphate ground in Belgium

TABLE 2.—IMPORTS OF THE PRINCIPAL PHOSPHATIC FERTILIZERS, 1925–34.

Year ended 31st March,	Bonedust and Bone-char.	Basic Slag.	Super-phosphate.	Pacific and Indian Oceans Phosphate.	Egyptian Phosphate.	Moroccan Phosphate.	North African Phosphate (other).
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
1925 ..	2,452	45,682	10	108,163	8,530	..	..
1926 ..	2,085	44,314	500	97,488	10,037	..	..
1927 ..	1,805	53,327	15	161,541	5,979	..	..
1928 ..	725	48,913	6,616	143,373	6,603	13,389	..
1929 ..	554	93,222	1,037	178,057	6,000	22,173	12,499
1930 ..	1,420	94,332	525	170,997	1,000	35,348	37,424
1931 ..	795	67,766	..	156,950	..	8,038	250
1932 ..	180	47,776	300	178,466	..	..	..
1933 ..	30	42,022	..	214,445	160	..	..
1934 ..	..	14,982	..	182,333	350	..	..

TABLE 3.—IMPORTATION (IN TONS) OF PRINCIPAL COMMERCIAL FERTILIZERS FOR YEAR 1933–34, SHOWING COUNTRIES OF ORIGIN AND NEW ZEALAND PORTS OF ENTRY.

New Zealand Port of Entry.	Chile.	Pacific and Indian Oceans Islands.		Great Britain.			Canada.	Belgium.		France.		Germany.	Poland.	Netherlands.		Egypt.	Spain.
	Nitrate of Soda.	Source.	Raw Phosphate.	Basic Slag.	Sulphate of Ammonia.	Phosphate.	Sulphate of Ammonia.	Basic Slag.	Raw Phosphate.	Potash Fertilizers.	Basic Slag.	Potash Fertilizers.	Potash Fertilizers.	Potash Fertilizers.	Phosphate.	Phosphate.	Potash Fertilizers.
Auckland ..	454	Nauru/Ocean ..	76,235	4,651	1,150	5	200	1,132	3,275	615	..	760	110	..	400	..	200
		Tuamotu ..	4,907														
		Seychelles ..	10,337														
		New Caledonia ..	2,286														
New Plymouth ..	105	Seychelles ..	1,251	3,510	..	..	..	3,464	1,052	155	..	170	75	..	..	..	100
		Nauru ..	10,363														
Wanganui ..	..	Nauru/Ocean ..	13,720	..	..	..	..	..	..	..	..	..	..	..	..	..	..
		New Caledonia ..	936														
		Tuamotu ..	2,115														
Napier	..	..	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..
Wellington ..	50	..	..	1,205	288	300	..	690	..	100	15	245	25	..	125	250	55
Nelson	..	..	..	..	250	..	..	25	..	20	..	105	..	..	..	..	..
Lyttelton ..	140	Nauru/Ocean ..	19,986	30	355	..	..	..	..	85	..	105	..	..	..	..	..
		New Caledonia ..	555														
Timaru ..	..	New Caledonia ..	1,159	..	45	..	..	..	..	..	..	62	..	..	..	..	..
Dunedin ..	..	Nauru/Ocean ..	26,926	..	400	..	..	100	..	240	..	127	..	2	..	100	..
		Madagascar ..	3,658														
		New Caledonia ..	527														
Invercargill ..	..	Seychelles ..	7,372	60	125	..	..	100	125	38	..	95	135	..	155	..	190
Totals ..	749	..	182,333	9,456	2,613	305	200	5,511	4,452	1,270	15	1,669	345	2	680	350	545

NOTE.—Additional items, not included in above table, are as follows: Unenumerated fertilizers, 28 tons (Great Britain, Germany); and sulphate of iron, 6 tons (Australia).

CASTRATION, EARMARKING, AND DOCKING OF LAMBS.

W. T. COLLINS, District Superintendent, Live-stock Division, Auckland.

AT this time of the year a large number of lambs are being castrated, docked, and earmarked, and, although the operations are quite simple ones, many deaths are liable to occur unless the operations are carefully carried out and due care taken of the lambs during the time they are being handled and afterwards.

In the first place, the site on which the operations are carried out is an important matter and should receive due consideration. Old yards that have been in use for a number of years should be avoided as much as possible, as these are invariably contaminated with large numbers of organisms that set up blood-poisoning, &c., and the open wounds that result from the operations are liable to become infected and so lead to the death of the lambs. Even yards that may be looked upon as comparatively new and that have been in use only for a year or two should not be considered safe, as they are always liable to be infected, especially if they have been in fairly constant use. To avoid trouble it is far better to erect temporary yards in some clean part of the paddock. These are quite easy to erect; they necessitate only a few rolls of good strong wire netting, some stakes, and a few hurdles. The amount of material required and the size of the yards must, of course, be governed by the size of the flock that has to be handled. If a convenient and good clean site can be found near an existing wire fence, it will save much work, as the wire netting can be fastened to the posts. Actually only two yards are required—*i.e.*, one large one into which the ewes and lambs are mustered and a small one leading out of it into which they are driven to enable the lambs to be easily caught. It is always as well, however, to have a third yard in a handy position so that all the ewes that have not had lambs can be separated, and so give the ewes and their lambs more opportunity to make full use of the better pastures.

If the small yard is constructed of hurdles, a board approximately 6 in. wide on which the catcher places the lamb should be nailed on the top of one of them. This will be found very much more convenient than resting the lamb on a rail, and gives the catcher a very much better chance of presenting it in a good position to the person who is carrying out the operations.

On flat or low undulating country the erection of a temporary yard on a new site each year should present no difficulties, as the netting, stakes, and hurdles can be carted or sledged to the chosen site. On hilly country, however, this is not always practicable, nor is it always practicable to select a fresh site each year. Young lambs on hilly country are notoriously difficult to muster and to control when mustered, and it is only by careful and judicious handling that bad breaking-away can be avoided. There are nearly always certain ridges and gullies towards which the ewes and lambs run more freely, therefore sites on these places are selected each year for the temporary yards. However, the possibility of these places becoming infected and dangerous is very much less than where permanent

yards are employed, as the former are in use only once a year, and therefore have a good chance of becoming free of infection before the following season. It is not always possible to make the small catching-yard with hurdles on hilly country, but a suitable one can be made with the wire netting, using additional stakes to make it safe. An extra length of wire netting to run out a wing to lead the sheep into the yards will also be found to be very helpful.

Catching.

When the ewes and lambs are first mustered into the yards they are in a somewhat heated condition, and so it is advisable to give them time to become normal before operations commence. During this time the operator should attend to his knives, &c., and see that everything is in good working-order.

Once operations have commenced the work should go on steadily so as to get the lambs to their mothers as soon as possible. It is not necessary to draft the lambs from the ewes; in fact, this is not possible where temporary yards are used. Small drafts are driven into the catching-pens, and the fact that the ewes are still with the lambs makes it easier to handle the latter. The lambs should be caught and picked up carefully and carried over to the board on which they are to be placed for the operation. The hind legs should be drawn up between the fore legs and the lamb set on the board in front of the operator. Care should be taken not to draw the legs too far apart or too far back as this may result in injury to the joints or back. As soon as the various operations are completed the lamb should be carefully placed on its feet outside the catching-pen.

When the ewes and lambs are mustered for docking it is, as a rule, especially on hilly country, the first time the ewes have been yarded since crutching, so advantage can be taken of the opportunity of giving them any attention they require. The dry ewes should be picked out and penned ready for removal from the mob, and any ewes that require dagging or treatment for foot-rot should be attended to.

Castration.

There are several methods of carrying out this operation—*e.g.*, drawing the testicles out, removing them by severing the cord with a knife or with a searing-iron, and the Burdizzo or bloodless method. Probably the most common is the first method mentioned.

There are two methods of exposing the testicle, one by cutting off the end of the scrotum or purse, and the other by splitting it. Each method has its own advocates. Probably the better method of the two is the former—*i.e.*, cutting off the end of the purse—as this allows for better drainage in the event of any infection taking place. This method also has a point in its favour as it shortens the scrotum and less wool is grown in a region that is more likely to become soiled. After the scrotum has been cut and the testicles exposed, they should be drawn one at a time, either with the teeth or with a special instrument made for the purpose. When drawing the testicles out the neck of the scrotum should be firmly grasped between the finger and thumb—this minimizes to a great extent any likelihood of injury to the inguinal region. Injuries in this region lead to hernia or possibly peritonitis, and death of the lamb.

Some operators, instead of drawing the testicle, remove it by severing the cord with a sharp knife. This method has an advantage over drawing, as there is not the same likelihood of the inguinal region being injured, but it has a disadvantage in that there is usually more loss of blood. Bleeding from an artery is arrested by the formation of a blood clot, and this takes place more rapidly after drawing the testicle, as the internal lining of the artery is more extensively damaged by this method than by cutting straight through with a sharp knife.

Removing the testicle by searing through the cord with a hot iron is advocated by some owners. This is a very much slower method than the ones mentioned above, but it has the advantage in that there is much less hæmorrhage following the operation.

The Burdizzo or bloodless castration has found favour with some farmers. The advantage in this method of castrating is that there is no open wound left through which infection may take place, and also no loss of blood. The disadvantage of the method, however, is that it is not possible, especially in young lambs, for the operator to be quite sure he has carried out the operation successfully. A special instrument is used, and the object aimed at is to crush the main artery leading to the testicle and so cut off the blood-supply. If properly carried out the testicle atrophies and disappears in the course of a few weeks. In many cases, however, the artery is not properly crushed and the blood-supply is not completely cut off, with the result that the testicle does not atrophy, although in many cases it does not develop as it normally should do.

In using the Burdizzo castrator care should be taken to see that only one cord is crushed at a time. If an attempt is made to crush both cords at one time, there is a risk of the blood-supply to the scrotum being cut off, and this may result in gangrene or death of the parts, followed by death of the lamb.

One of the reasons for failure to get good results with the Burdizzo castrator, especially in young lambs, is that the cord, being very thin, is not placed well within the jaws of the instrument and therefore is not crushed properly. Other reasons are that the instrument is applied too close to the testicle or even in some cases on to the testicle itself, with the result that the artery is not affected and the blood-supply not to any extent interfered with. In older lambs with more developed testicles the Burdizzo castrator may give good results if care is taken at the time it is used, but failures and the necessity for a second operation a few months afterwards are not unusual.

It is quite common to see lambs killed at the freezing-works with well-developed testicles in spite of the fact that they have been operated on by the Burdizzo castrator. If these lambs had been left till they were two-tooth or over, it is quite possible they would have been classed as rams or stags. Complaints have been received from freezing-works on this score.

Earmarking.

Under the Stock Act a brand means, in the case of sheep, a wool-mark, distinctly and plainly made with pitch, tar, paint, raddle, or lamp-black mixed with oil or tallow, in plain and distinct letters,

figures, or otherwise, not less than 3 in. in length, on the sides, back, shoulders, hips, or rump of the sheep, in conjunction with any one of the following marks, that is to say: (1) An earmark distinctly and plainly made by cutting, splitting, or punching the ear, but so that in no case shall more than one-fourth of the ear be removed; or (2) a metal clip affixed to the ear; or (3) a tattoo-mark distinctly and plainly imprinted on any part of the skin; or (4) a fire-mark distinctly and plainly made on the horn or face. Provided that the aforesaid wool-mark shall not form part of the brand in any district which is for the time being exempt from wool-marking.

A metal clip on the ear is seldom used in conjunction with a wool-mark to enable an owner to distinguish his own sheep from those of his neighbour, but is often used to identify particular animals in his flock, especially studs. The same remarks apply to the tattoo-mark, which is very useful in identifying particular animals, but if used in a general way the task of picking strangers out of a mob would entail a great deal of work, as each sheep would have to be caught and the ear examined. A fire-brand on the face has been used on occasions to identify particular sheep, but is seldom, if ever, employed now.

Some districts are exempt from wool-marking, and in these the metal clip, tattoo-mark, or fire-brand become the registered brand by which the owner identifies his sheep. Even in districts that are not exempt from wool-marking the method of marking cannot be looked upon as being satisfactory, as the growth of wool in a few months eliminates the possibilities of deciphering it.

It can be conceded that the majority of the owners rely upon the earmark to enable them to identify their own sheep, and, this being so, it is rather remarkable that more care is not taken in earmarking and all the animals marked as uniformly as possible.

The marking of the ears cannot be said to improve the appearance of any sheep, and if carried out in a haphazard, slipshod manner it will certainly detract from their appearance. One occasionally sees mobs of sheep advertised for sale about which it is stated they are "All one line" or "All one mark." In some of these the earmark has been put on very well and all the sheep are marked in a uniform manner, showing that some care has been taken at the time the earmarking was carried out, but in others, however, it is only by careful examination that one can satisfy oneself that all the sheep are carrying the same mark. If the earmark is to be a piece out of the bottom of the ear, it should be the aim of the person who is doing the earmarking to place this in the same part of each sheep's ear so that all look alike, and not, as is often seen, sometimes near the head and sometimes near the tip of the ear. The depth the mark is made in the ear is also very erratic in many cases. Sometimes the same mark is put well into the ear and at others it is very shallow and very easily leads to mistakes and disputes as to ownership. The same remarks apply to all earmarks no matter what size or design. The more uniform they are the better for identification purposes as well as for the appearance of the mob as a whole.

Docking.

The operation of cutting the tail off the lamb is usually carried out immediately before the animal is released. The cut should be made at about the second or third joint, and care should be taken to

leave the dock of uniform length. Before cutting the tail it is advisable to work the skin up towards the body so that when cut through it slips down and helps to cover the wound. If the skin is pulled down towards the end of the tail and then the cut made, the skin recedes, with the result that the bones are exposed and there is more chance of infection and delay in healing.

Some farmers use the searing-iron for taking off the tail, but it is doubtful whether it has any advantages over the knife. The searing-iron is always liable to injure the end of the dock, and, although there is less hæmorrhage, the wound may take longer to heal.

Age for Operations.

The best age to castrate and dock lambs is when they are about three or four weeks old. To operate on them at this age is quite practicable where small flocks are being dealt with, but not practicable on high country where larger flocks have to be handled. On this kind of country the lambing often extends over a period of about two months, and when docking time comes round many of the lambs are over eight weeks old, whilst others are very young.

Although many lambs, especially the older ones and ones that are thriving very well, bleed rather freely after being operated on, it is not often that deaths occur through this alone. The lambs may get a slight check as a result of the amount of blood lost, but, if healthy and thriving, it does not appear to upset them much, for they soon recover. In the case of lambs in high condition, the loss of blood may even have a beneficial effect and leave the lamb less susceptible to pulpy kidney, a disease to which well-conditioned, plethoric lambs are subject. Lambs bred on poor country and not thriving well feel the effect of the operation and loss of blood, therefore it may be advisable to use the searing-iron in these cases.

"Mothering."

As soon as all operations have been completed and the ewes and lambs are out in the paddock again, it is very necessary to see that the lambs "mother" properly. The lambs at this time are far too young to fend for themselves. The very young ones will probably die if they do not find their mothers; the older ones may survive, but do not thrive, and by shearing-time are simply culls and no credit to the flock.

In small lots and small paddocks mis-mothering should not occur, but in high country lambs may have difficulty in finding their mothers. It is advisable to complete all operations early in the afternoon, so that mothering can take place before nightfall. To hasten this, the mob should be held in the vicinity of the yard and not allowed to wander too far, as there is always the likelihood of a ewe with twins returning to her feeding-ground with only one lamb and not troubling about the other.

Cleanliness is just as important in castrating and docking lambs as in all other operations. The operator should wash his hands carefully before commencing operations, and should wash them at frequent intervals while operations last. He should also have a bucket of disinfectant in a handy position into which his hands can be plunged.

The only instruments required are two knives, both of which should be kept clean and sharp and frequently placed in disinfectant. Some operators use one knife for both operations, but it is advisable to have two, using one for castrating and the other for docking, as the latter operation tends to make the knife blunt in spite of the fact that in lambs the bones of the tail are comparatively soft. When using the knife the operator should aim at making one clean cut. If more than one cut is made, ragged edges are left, and these considerably delay the process of healing.

Before the lambs are liberated the wounds should be swabbed or otherwise treated with some disinfectant; this not only minimizes the chances of infection, but tends to keep away flies that may be attracted by the blood.

As soon as operations have been finalized the tails should be counted to get a tally of lambs, and then they should be carefully collected and burned and not scattered about, as, if not burnt, they only create centres from which infection may take place.

A VIRUS DISEASE OF STRAWBERRIES IN NEW ZEALAND.

E. E. CHAMBERLAIN, Mycological Laboratory, Plant Research Station, Palmerston North.

THE successful cultivation of strawberries in this country has become increasingly difficult owing to the introduction of disease. In the Auckland District, strawberry-beds, which at one time yielded profitable crops over periods of three to four years, have now to be replanted every year. In the South Island, the beds are lifted every two years instead of every five to seven years as previously. These changes in cultural practice have become necessary on account of the increasing prevalence of two degeneration diseases—a root-rot, and a disease which causes a stunting of the plants. The present paper is concerned only with the latter. This disease is widely spread, infected plants having been received from the Auckland, Poverty Bay, Nelson, Canterbury, and Otago districts.

A similar type of degeneration, causing a stunting of the plants, has, during the past ten to fifteen years, occurred in the strawberry-growing regions of Europe and North America. It has been attributed to nematode, insect, or mite injury (Ballard and Peren, 1923; Briton-Jones and Staniland, 1927; Massee, 1934) and to virus diseases (Plakidas, 1927; Harris, 1933). The variations in symptoms described suggest that several diseases are involved. Four of these have been proved by insect transmission or grafting experiments to belong to the virus group of diseases—viz., yellows or xanthosis (Plakidas, 1926, 1927), witches' broom (Zeller, 1927), crinkle (Zeller and Vaughan, 1932; Zeller, 1933; Vaughan, 1933), and yellow-edge (Harris, 1933). Of these four, xanthosis and yellow-edge appear to be very similar and the symptoms described for either agree closely with those of the New Zealand disease. Witches' broom and crinkle, however, appear to be quite distinct diseases, and their symptoms differ from those of xanthosis.

Symptoms.

The first symptom of the disease is a yellowing of the young leaves which are smaller than the normal. As the petioles fail to lengthen these leaves become bunched around the crown. The yellowing gradually becomes more pronounced especially at the leaf-margins. The older foliage is not visibly affected and remains for some time a striking contrast to the stunted younger growth (Fig. 1). The old leaves, however, tend to die prematurely and when they have fallen the infected plant is much stunted (Fig. 2). The flower trusses are smaller than the normal, the stalks are shortened, and any fruit which develops is small, distorted, and of little value. In the early stages the roots are healthy. As is common to all diseases of this type a plant once infected never recovers.

FIG. 1. VIRUS-INFECTED STRAWBERRY PLANT.

An early stage of the disease, showing small yellowed leaves together with normal leaves on the same plant.

[*Photo by H. Drake.*]

Cause.

When in North America in 1929 the Mycologist visited several strawberry-growing districts on the Pacific Coast. The xanthosis of strawberries there so resembled stunted plants in New Zealand that on his return he suggested that the disease in this country might be due to a virus. This view was supported by the fact that field observations and cultural studies had failed to correlate the diseased condition with either mite or aphis infestation or with fungous or bacterial infection of the plants. An attempt was therefore made, both by insect transmission and by artificial inoculation, to determine whether the disease was of a virus nature.

Insect Transmission.

Experimental Method.—Healthy plants were obtained by raising seedlings. Of the several hundred plants raised from seed in insect-proof houses at this Station not a single plant has shown any sign of disease. The healthy seedling plants were grown in 6 in. pots and wire frames then fitted to these. Muslin covers were drawn over the frames and tied so as to form insect-proof cages (Fig. 3). *Capitophorus fragariae* Theo.,* the aphis most commonly found on strawberries in this country, was collected from apparently healthy plants. Some of these aphides were transferred to virus-infected strawberry-plants and others to healthy seedlings. The aphides were left to breed on these plants. Leaves carrying aphides were removed from the infected or healthy plants and placed in the cages. The insects soon migrated from the leaves on to the healthy plants.

FIG. 2. VIRUS DISEASE OF STRAWBERRIES.

On left: Plant exhibiting characteristic symptoms—small leaves and stunting. On right: Healthy plant.

[*Photo by H. Drake.*]

For the first experiment, carried out during the 1931–32 season, there was no available glasshouse space so the caged plants were placed outside. The pots were let into the ground to prevent them from blowing over. Thirty plants were placed in three rows of ten plants per row. Two plants in each row were runners from Marguerite seedlings and the others were runners from Jersey Queen seedlings. On the 15th December, 1931, to each plant of one row 50–100 aphides from a virus-infected plant were added. The other two rows were left as controls, one being free from insects and the other having 50–100 aphides

* The identification of this aphis was kindly made by Mr. W. Cottier, Assistant Entomologist at this Station.

from a healthy plant added to each plant. At the end of twenty-three days all plants were removed to the glasshouse where the covers were removed and the plants fumigated. After the covers had been replaced the plants were again placed outside. Six weeks later the plants were again taken to the glasshouse and fumigated. The covers and frames were removed and the plants placed in an insect-free house. At this stage no virus symptoms were present and almost two months elapsed before the plants were again examined. Four months after the insects had been added three of the ten plants which had been infested with aphides from a diseased plant showed definite symptoms of virus infection. All the ten plants of each of the control rows remained healthy.

FIG. 3. MUSLIN CAGES USED FOR INSECT TRANSMISSION OF THE STRAWBERRY VIRUS. [*Photo by H. Drake.*]

A second experiment was carried out during the winter of 1934, and this time the plants remained in an insect-proof glasshouse throughout the duration of the experiment. Twelve plants, all runners from one healthy seedling plant, were planted in 6 in. pots and covered with muslin cages as in the previous experiment. Four plants were left free of insects as controls. On the 1st May, 1934, to each of the remaining eight plants were added about twenty aphides which had been bred on a virus-infected plant. The aphides were allowed to remain on the plants for four weeks before they were fumigated. After fumigation the plants were placed, uncovered, in an insect-free glasshouse. Three months after the insects had been placed on the plants three of the eight plants were showing symptoms of the virus. All control plants remained healthy.

Artificial Inoculations.

An experiment, using sixteen seedling plants grown from Marguerite strawberry seed, was carried out on 27th May, 1933. Eight plants were inoculated by rubbing the leaves with muslin moistened with juice extracted from the leaves of a virus-infected plant. The eight control plants were treated in the same way with juice extracted from the leaves of a healthy seedling plant. The plants were kept in an insect-free glasshouse for three months and a half, but no sign of virus disease appeared on any of the plants.

Method of Spread.

Strawberry virus is transmitted from the mother plant to the runners. The latter, although infected, do not immediately develop symptoms of the disease and may be set out as healthy plants. The introduction of such apparently healthy plants from nurseries is probably the chief manner of dissemination of the strawberry virus. Once the disease has been introduced, it is spread through the fruiting-beds by means of the strawberry aphis (*C. fragariae*), which is prevalent throughout New Zealand, on this plant.

Remedial Treatment.

The only method of combating this disease is to produce disease-free plants in an isolated area removed from strawberry-growing localities. These plants could then be bulked to establish nursery-beds, producing in time the requirements of commercial growers.

Under ordinary commercial conditions the disease may be held in check by rogueing of infected plants. In nurseries a thorough examination of the plants should be made once a week and all infected plants removed. It is necessary to destroy both the mother plant and attached runners, since these runners afford the principal means by which the disease is spread. Rogueing of all diseased plants from the fruiting-beds will help to prevent the spread of the virus.

Summary.

(1) A virus disease is one of the causes of degeneration of strawberries in New Zealand.

(2) The chief symptoms of the disease are: A marked stunting of the plant, the development of small leaves with short petioles and a yellowing of the foliage.

(3) The disease is spread by the strawberry aphis (*Capitophorus fragariae* Theo.).

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A SIMPLE METHOD FOR DETECTING "NON-ACID" MILK.

G. A. Cox, Dairy Research Institute (N.Z.), Palmerston North.

SLOW development of acid in the cheese-vat, due to the presence of "non-acid" milk, is a frequent cause of trouble in New Zealand cheese-factories. For the detection of such "non-acid" milk there is at present available to the factory-manager an application of the vitality test described by Whitehead and Cox.* The vitality test is used primarily for testing the vitality of a starter, but can also be applied to the detection of "non-acid" milk by using the same starter in samples of suspected milk. During the course of investigations at the Dairy Research Institute a new method, which is described in the present paper, has been worked out.

The method depends in principle upon the fact that "non-acid" organisms, when growing in milk, produce an inhibitory substance which holds up the growth of added starter organisms. If milk containing "non-acid" organisms is pasteurized, and starter organisms and methylene blue solution are added, the growth of the starter organisms is markedly retarded by this inhibitory substance. Hence the blue colour remains for a longer time than in a control milk which is similarly treated, but in which there are no "non-acid" organisms. The presence of the "non-acid" organisms is detected simply by the fact that the blue colour persists for a long time.

When a factory-manager experiences trouble due to the presence of "non-acid" milk in one of his vats the source of the trouble lies in all probability among those milk-supplies which contain large numbers of bacteria—*i.e.*, among the milks which have a methylene-blue reduction time of two hours or less. All such milk-supplies should be examined for the presence of "non-acid" organisms according to the method described below.

DETAILS OF THE METHOD.

A supply of test-tubes is needed, such as those used for the methylene-blue reductase test. These tubes should be numbered suitably. From each of the suspected milks a 20 c.c. sample is transferred direct from the weighing-vat to a test-tube by means of a dipper. A control sample is also taken from one of the best supplies. The

* Whitehead and Cox (1932): *N.Z. Jour. Sci. & Tech.*, *13*, 304.

tubes of milk are pasteurized by immersion for ten to fifteen minutes in a bath of water the temperature of which has been raised previously to 145° F. (63° C.). Then, after the tubes have been cooled by immersion in cold water, three drops of a well-mixed starter from a vertically held pipette and 1 c.c. of ordinary methylene-blue solution are added to each. The tubes are inverted once (with finger over mouth of tube) to mix the contents, and are incubated in a bath at 98° F. (37° C.). An occasional examination is made to find the time taken for the blue colour to disappear. With a normal starter the colour in the control sample should disappear in about two hours and a half. If "non-acid" organisms have been present in sufficient numbers before pasteurization in any of the samples, the colour in such tubes will persist for several hours longer than in the control. Sometimes the colour in a tube may remain only an hour or two longer than in the control. This indicates a border-line case. Such a milk would probably not cause any slowness in the vat, especially if mixed with a reasonable quantity of normal milk, but it is a potential source of trouble, and may be worse on some days than on others. Where there is actual trouble in the vat, however, at least one sample will be found in which the blue persists for several hours longer than in the control.

Summary of Method.

Measure 20 c.c. of various milks into test-tubes.

Pasteurize by immersion of tubes in water at 145° F. for ten to fifteen minutes.

Cool the tubes in cold water.

Add three drops starter and 1 c.c. methylene-blue solution to each tube.

Incubate tubes at 98° F., and note time taken for blue colour to disappear.

Precautions.

(1) The tubes should be clean, but they do not need to be sterilized.

(2) The dipper used for transferring milk to the tubes should be washed each time before use.

(3) The starter should be well mixed by pouring from one vessel to another several times.

(4) The finger used for clothing the mouth of the tube when mixing the contents should be wiped, so as to avoid mixture of one milk with another.

Experiment showing Sensitiveness of the Method.

In order to find the sensitiveness of the method for detecting "non-acid" organisms, the following experiment was carried out in the laboratory.

Raw whole milk was collected at the Massey Agricultural College milking-shed late in the afternoon, and was distributed in flasks. These flasks were then inoculated with various amounts of a known "non-acid" culture, and were incubated overnight at 68° F. (20° C.). A flask of milk to which there was no addition was also incubated as a control. Next morning tests were carried out on the various samples. These samples would correspond more or less with various uncooled evening milks delivered at a factory the next morning by farmers.

The results of these tests are shown in the following table:—

Test No.	I. Number of Organisms per Cubic Centimetre.	II. Reductase Test on Raw Milks: Time for Decolourization.	III. Vitality Test.			IV. Methylene-blue "Non-acid" Test: Time for Decolourization.
			5½ Hr.	6½ Hr.	Rise.	
1 ..	204,000,000	¼ hour.	1·5	1·4	−0·1	>6¼ hours
2 ..	127,000,000	½ hour.	1·3	1·2	−0·1	>6¼ hours.
3 ..	117,000,000	½ hour.	1·4	1·4	0·0	>6¼ hours.
4 ..	116,000,000	¾ hour.	1·7	2·3	0·6	>6¼ hours.
5 ..	94,000,000	1½ hours.	1·9	3·3	1·4	>6¼ hours.
6 ..	56,000,000	2 hours.	2·4	4·8	2·4	3¾ hours.
7 ..	40,000,000	..	2·7	5·1	2·4	2¼ hours.
Control ..	8,000,000	3¼ hours.	2·9	4·8	1·9	2¼ hours.

In column I are shown the bacterial counts on the raw milks in numbers of organisms per cubic centimetre, as done by Breed's method.

In column II are shown the reductase times for the raw milks. The shortest times for the reduction of methylene-blue indicate the most highly contaminated milks.

It is important to bear in mind the distinction between the *reductase test* and the *methylene-blue "non-acid" test.*" In the reductase test methylene-blue is added to the raw milk, and the time for decolourization at 98° F. is noted. In the methylene-blue "non-acid" test the samples of milk are first pasteurized. Then starter and methylene-blue are added, and the time for decolourization at 98° F. is noted. The *reductase test* is used for finding the bacterial quality of the milk. The *methylene-blue "non-acid" test* is used for detecting whether "non-acid" organisms have been present in appreciable numbers.

In column III are shown the results for the detection of "non-acid" milk by the application of the vitality test. These tests were carried out as follows: 150 c.c. of the various milks were pasteurized in bottles at 145° F. (63° C.) for half an hour, and were then cooled to 86° F. (30° C.). Each was inoculated with 1·5 c.c of the same starter, and the tests were further carried out in the usual manner for vitality tests. Titrations on the whey at five hours and a half and six hours and a half are recorded. Where has been a high contamination by "non-acid" organisms, the rise in acidity is nil. A smaller contamination by "non-acid" organisms has restrained the acid production somewhat.

In column IV are shown the results for the methylene-blue "non-acid" test carried out as described in this paper. Samples which had contained a large number of "non-acid" organisms before pasteurization retained the blue colour for over six hours and a quarter. In one test the blue colour disappeared in three hours and three-quarters. Evidently the smaller number of "non-acid" organisms present in this sample was such that the inhibitory substance produced restrained the growth of added starter organisms only a little.

The results given in the table show that the methylene-blue "non-acid" test is somewhat more sensitive than the vitality test for detecting "non-acid" milk. Samples giving a small rise in acidity by the

vitality test showed up by the methylene-blue "non-acid" test as most distinctly "non-acid." A sample giving a normal rise in acidity by the vitality test was shown to give a fairly definite indication of being "non-acid" by the new method. Thus the new test would pick out "non-acid" milk in certain cases where the application of the vitality test would fail to do so, and hence would give a warning as to those samples which, although not at the moment causing trouble in the vat, might possibly do so on some occasions.

SUMMARY.

A simple test for detecting "non-acid" milk has been described. This test is suitable for use by factory-managers experiencing trouble with slow vats, and wishing to find the cause of the trouble. The test should be applied to those milk-supplies which usually have a reductase time of two hours or less, as the cause of trouble is most likely to occur amongst the most highly contaminated milks, although a milk which has a reductase time of over two hours may on occasion show the presence of "non-acid" organisms by the test. From the figures quoted it is evident that a milk which is capable of causing "non-acid" trouble must necessarily have a fairly high bacterial count. The new method has the advantage over the vitality test in that it is somewhat more sensitive and is simpler in operation.

The author's thanks are due to Dr. H. R. Whitehead for his advice and criticism.

FARM SEEDS.

N. R. FOY, Seed Analyst, Department of Agriculture, Palmerston North.

GERMINATION OF 1934 CERTIFIED PERENNIAL RYE-GRASS.

THE appended table indicates the average germination capacity of samples of certified perennial rye-grass officially drawn from January to May, 1934.

Production District.	Number of Samples.	Germination Capacity.		
		Maximum.	Minimum.	Average.
		Per Cent.	Per Cent.	Per Cent.
Hawke's Bay	224	99	50	94
Poverty Bay	125	99	60	94
Manawatu	61	97	34	89
Wairarapa	10	98	83	93
Wanganui	3	86	75	80
Marlborough	2	98	96	97
North Canterbury ..	32	97	52	89
Mid-Canterbury ..	6	98	86	92
South Canterbury ..	21	95	30	65
North Otago	13	96	41	58
Central Otago ..	37	99	62	94
Otago	2	83	86	80
Southland	14	94	12	52

AUSTRALIAN REGULATION REGARDING COCKSFOOT IMPORTS.

By a Proclamation gazetted on the 17th May, 1934, the Federal Government prohibited the importation into the Commonwealth of Australia of cocksfoot (*Dactylis glomerata*) seed unless satisfactory evidence is produced that the seed is of a highly persistent strain grown under Government supervision in the country of origin, or, alternatively, unless the seed is coloured by thoroughly mixing the total bulk of the seed with one-half of 1 per cent. of fine polishing rouge until the colour is uniformly distributed on the seed.

SEED-TRADE STATISTICS.

The table below indicates the imports and exports (in hundredweights) of the main farm seeds for the quarter ending March, 1934 :—

Seed.	Exports.			Imports.
	Certified.	Uncertified.	Total.	
Alsike	..	..	1	604
Red clover	..	..	509	289
White clover	41	109	150	51
Other clover	..	..	114	443
Brown-top	135	74	209	..
Chewing's fescue	..	..	2,306	..
Crested dogstail	..	..	193	..
Cocksfoot	356	341	697	889
Lucerne	..	..	*	Nil
Paspalum	..	..	..	1,021
Poa pratensis	..	..	..	4
Perennial rye-grass ..	814	6,076	6,890	Nil
Rye-grass, Italian, &c. ..	..	..	5,745	Nil
Timothy	..	..	..	472
Other grass	..	..	779	211
Rape and kale	..	..	..	30
Turnip and swede	..	..	..	6
Total	1,346	6,600	17,593	4,020

*Included with other grass.

SEED-STAINING.

The Seeds Importation Act, 1927, requires that before certain seed is permitted entry into the Dominion a proportion of such seed must be stained red. The seeds at present covered by the provisions of the Act are—White clover, 10 per cent.; lucerne, 10 per cent.; and cocksfoot, 1 per cent. Seed-staining is enforced in many countries throughout the world, the objective being in the majority of cases the protection of home-grown strains by the prevention of substitution and adulteration with seed of inferior plant types. In some countries different colours are used to distinguish between seed imported from different parts of the world, so that buyers may select according to their requirements.

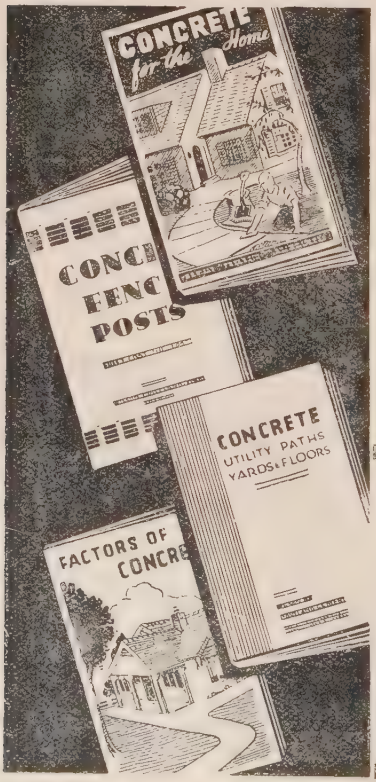
VITALITY OF SEEDS.

Loss of vitality in seeds is caused by a decline of energy following chemical changes in the materials stored within the seed and by pathological influences—bacteria and fungi. Vitality as measured by

the energy of growth decreases more quickly than the viability or capacity to germinate. The normal decline of vitality is accelerated by unfavourable conditions such as high humidity, which causes increased respiration and in consequence a greater loss of energy. The continuance of such losses will result in a stage being reached when the seed still retains the capacity to "germinate" but lacks sufficient energy to produce normal roots to enable it to establish an independent existence. In seed-testing practice these abortive seedlings are discarded as dead seeds.

In trials conducted over a number of seasons the use of a mixture of superphosphate and carbonate of lime appeared to provide the best means of overcoming serious germination injury likely to result from the use of superphosphate alone. Trials at the Plant Research Station with carbonate of lime from twenty different sources, however, have shown that there is considerable variation in the effectiveness of the different limestones in correcting injury caused by superphosphate. The cause of such variation and a possible remedy in the case of the more unsatisfactory lines of carbonate of lime is under investigation.

Large numbers of calves are still lost or their constitution impaired as the result of pulmonary and intestinal parasites. In the prevention and treatment of these parasites, management and feeding play a more important part than drugs. Supplementary feeding is the sheet anchor in combating the effects of parasites in young cattle, and without this any line of medicinal treatment cannot be expected to give the best results.—*Report, Director of Live-stock Division.*



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SEED CERTIFICATION CHARGES.

THE following scale of charges will be inaugurated in the 1934–35 season :—

FIELD CHARGES.

GENERAL CONDITIONS.

1. Field charges are computed on an acreage basis, but certain minimum fees are payable in respect to each crop entered by any one grower, and additional fees are payable in respect to late entries.

2. Closing dates are determined for each crop in each district, information on which may be obtained from the local Instructor in Agriculture. Applications not received on or before the closing dates will be regarded as late entries and must be accompanied by a late entry fee. Late entries will be accepted and regarded as eligible only provided the Department agrees to perform the services required.

3. All field charges are payable by the grower and whenever a fee is due certification services will not be undertaken by the Department on behalf of that grower until such fee is paid.

4. The field charges, including the minimum fee and late entry fee, for any crop cover all entries of that crop made by any one grower on the one farm. The acreage for the purposes of charging is taken as the total acreage of any one crop entered by one grower on one farm, irrespective of whether this is in one or more paddocks.

5. (*a*) If a grower enters more than one kind of seed for certification, then on each kind the charges will be computed separately except as in 5 (*b*).

(*b*) In the case of two kinds of seed being harvested together—*e.g.*, white clover (eligible for certification) separated from certified rye-grass at threshing time—the field charges on the one kind of seed also cover the second kind, but machine-dressing fees on both kinds will be payable.

SPECIFIC FIELD CHARGES.

6. *Rye-grass, Cocksfoot, and Clover.*—(*a*) The charge will be at the rate of 1s. per acre or part thereof with a minimum charge of 10s. The total fees must accompany the grower's application.

(*b*) An additional late entry fee of 10s. must be paid by each grower in respect to each crop for which applications are received after the closing date. This fee must accompany the grower's application and in no case will it be refunded except as provided in 6 (*c*).

(*c*) Should an application for certification be ineligible or the application withdrawn in writing prior to field inspection, the total fees paid will be refunded.

(*d*) If an area is rejected at field inspection, then the minimum fee of 10s. and the late entry fee, if any, will be retained and the balance of the fees paid will be refunded.

7. *Brown-top.*—As in rye-grass, cocksfoot, and clover, except that—

(*a*) The charge will be at the rate of 1s. for every 20 acres or part thereof, with a minimum charge of 10s.

(*b*) Should both field inspection and paddock branding be deemed unnecessary, then the minimum charge of 10s. only will be made and the balance of the fee paid on that area will be refunded except as provided for late entry fees in 6 (*b*). If either field inspection or paddock branding is necessary these fees will not be refunded.

8. *Wheat.*—As in rye-grass, cocksfoot, and clover, except that the unofficial grain inspection is to be regarded as part of the field inspection.

9. *Potatoes.*—(*a*) There will be a sample trial fee of 10s. which must accompany the grower's application.

(*b*) There will be a second fee called a field inspection fee at the rate of 2s. 6d. per acre, with a minimum of 10s., which must be paid prior to crop inspection and not later than the 20th December in each season.

(*c*) An additional late entry fee of 10s. must be paid by each grower in respect to any fees, whether for sample trial or field inspection, received after the closing date. This fee must accompany either the sample trial or field inspection fees or both, and in no case will it be refunded except as provided in 9 (*d*).

(*d*) Should an application for certification be ineligible or be withdrawn in writing prior to the collection of samples, then the total fees paid in respect to sample trial will be refunded.

Should an application for field inspection be ineligible or be withdrawn in writing prior to field inspection and before the 20th December in each year, then the total fees paid in respect to field inspection will be refunded but not those in respect to sample trial.

(*e*) If an area is rejected at field inspection then the sample trial fee of 10s., the minimum field inspection fee of 10s., and the late entry fees, if any, will be retained and the balance of the fees paid will be refunded.

(*f*) Provided they comply with certain conditions, growers may market seed potatoes in wooden crates.

In such cases the Department will supply at no extra cost sticker certification labels in place of the certification tags adopted for use on sacks.

A charge of 6d. per hundredweight, with a minimum charge of 10s., will be made when sticker certification labels are required in connection with the packing in crates of seed potatoes that have already been passed as certified and for which certification tags have been issued.

Machine-dressing Charges.

General Conditions.

10. All machine-dressing charges and those entailed in redressing, blending, and splitting are payable by the merchant who undertakes the work, whether on his own behalf or on behalf of another party. Monthly accounts will be sent out to merchants. In the case of private individuals dressing seed, all machine-dressing charges must be prepaid.

11. Machine-dressing charges will be made at the time when a sample is drawn for the purity and germination certificate, except that no charge will be made for resampling sealed sacks for the purpose of a fresh purity and germination certificate.

12. A charge will be made at standard machine-dressing rates for resealing and retagging certified seed which is opened for the purpose of redressing or blending.

13. A charge will be made at one-half standard machine-dressing rates for resealing and retagging certified seed which is opened for the purpose of splitting, with a minimum charge of 2s. 6d. for each occasion that an officer's services are required for this purpose.

14. There will be no charge made for the sealing of machine-dressed seed which is being held temporarily with the object of blending, *provided that at the time of such sealing the merchant furnished a certificate in writing that such dressed seed is being held temporarily for the purpose of blending at a later period.* The full machine-dressing charges will, however, be made when such seed is blended and finally sealed, tagged, and sampled for a purity and germination certificate.

SPECIFIC MACHINE-DRESSING CHARGES.

15. *Rye-grass and Cocksfoot.*—Machine-dressing fee: 1½d. per bushel or part bushel of machine-dressed seed. The charge thus made on any one line must not be less than the amount computed at the rate of 6d. per sack or part sack.

16. *Clover.*—Machine-dressing fee: 1d. per 10 lb. (or part thereof) of machine-dressed seed. The charge thus made on any one line must not be less than the amount computed at the rate of 3d. per sack or part sack.

17. *Brown-top.*—As in clover.

18. *Wheat.*—½d. per bushel or part bushel.

—*Fields Division.*

CERTIFICATION OF SEED POTATOES.

CROPS PASSED TUBER INSPECTION DURING SEPTEMBER, 1934.

APPENDED is a list of growers whose crops have been subject to and have passed the tuber inspection in connection with the system of Government certification of seed potatoes conducted by the Department of Agriculture. The list supplements those published in the July, August, and September issues of the *Journal*, and refers to those crops passed during September.

In the June *Journal* was published a list of growers who have received provisional certificates. The acreage, percentages of foreign varieties present, and the group number and classification representing the relative merits of lines were given in that list, to which intending purchasers should refer.

AUCKLANDER SHORT TOP.

Mother Seed—
Carroll, J., R.M.D., Southbridge.
McPhail, W. A., Mitcham, via Rakaia.
Nicklaus, J. F., 104 Ryan's Road, Fendalton, Christchurch.

Commercial Seed—
Gaffeney, Mrs. M. F., Temuka.
Nairn, G., R.M.D., Lakeside.
Smith, G. G., R.M.D., Broadfields.

DAKOTA.

Mother Seed—
Chambers, L. J., "Carberry," Weedons.
Gardiner, C., Mitcham, via Rakaia.
Johnston, H. W., Dunsandel.
Jowers, G. C., R.M.D., Springston (Line B).
Morrish, F. E., Springston.
Seymour, J., Hawthornden Road, Christchurch.
Shellock, W., R.M.D., Te Pirita, Rakaia.

Commercial Seed—
Berry and Halliburton, 28 Dundas Street, Christchurch.
Carpenter, A. M. and F., Fernside, Rangiora.
Giles, N., Seadown, Timaru (Line A).

ARRAN BANNER.

Mother Seed—
Cooper, J., Croydon Road, Gore.
Government Pure Seed Station, Box 4, Lincoln.

ARRAN BANNER—*continued.*

Mother Seed—continued.
Hellyer, F. E., Macandrew Bay, Dunedin.

AUCKLANDER TALL TOP.

Mother Seed—
Cross, H. E., R.M.D., Weedons-Courtenay.
Eder, W., R.M.D., Sefton.
Government Pure Seed Station, P.O. Box 4, Lincoln.

Commercial Seed—
Beal, H. W., Eyreton, R.M.D., Kaiapoi.
Seyb, L., Washdyke, Timaru (Line B).

EARLY ROSE.

Mother Seed—
Burns, R. A. C., Te Pirita, R.M.D., Rakaia.

IRON DUKE.

Commercial Seed—
Government Pure Seed Station, P.O. Box 4, Lincoln.

MAJESTIC.

Mother Seed—
Cross, H. E., R.M.D., Weedons-Courtenay.

ROBIN ADAIR.

Commercial Seed—
Marshall, D., R.M.D., Leeston.

ARRAN CONSUL.

Mother Seed—
Government Pure Seed Station, Box 4, Lincoln.

—*Fields Division.*

SEASONAL NOTES.

THE FARM.

Control of Pastures in Summer.

DURING November and December pasture utilization should be designed to avoid as far as possible the development of flowering or coarse growth on pasture under grazing; as grass growth becomes more mature it becomes correspondingly more fibrous, less nutritious, and less digestible. In addition, bottom sward-forming species, such as white clover, may be hampered seriously. And, further, the more pastures are allowed to become tall and stemmy the more do they fall off in respect to their output of leafy herbage during a considerable and critical portion of the producing season—*i.e.*, during late summer and early autumn—whereas pastures which have not developed to the flowering-stage are characterized by a more continuous and greater production of leafy feed.

Much of the undue development of coarse summer growth of pastures would be obviated were ensilage exploited to the optimum extent. But even really judicious action relative to ensilage will not always give completely satisfactory control of the growth of pastures. Frequently, in practice, it proves impossible to assess exactly the area of grass sufficient to provide the feed required by stock. Farmers who rightly believe in good feeding prefer to have some feed to spare instead of being short of feed. A quantity of surplus feed that may arise in this way may not be sufficient to justify its being saved in the form of silage, but still it may be sufficient, if not dealt with, to lead to unsatisfactory control of the growth of the pastures. When this is so, the most satisfactory course is to check the development of coarse and stemmy parts in a field by topping of the pastures—*i.e.*, mowing the field to remove flower-heads. Often such topping is delayed until it is far too late to obtain the maximum benefit from it. Indeed, if topping is carried out close to the approach of the dry summer period customary in many districts, and if it leaves such a short stubble that increased drying-out of the soil is fostered during fine weather, then topping may have an undesirable result. Essentially, the purpose of topping is to remove flower-stalks and coarse growth, and it should lead to as little as possible mowing of fresh leafy growth suited for milk-production. Further, topping is to be looked upon as an emergency rather than as a routine measure—the occasion for it arises because more feed becomes available than was counted upon. From this it follows that if a substantial portion of a farm calls for topping, then judgment was astray earlier in the year in that sufficient of the grassland was not closed for hay and silage. As the feed available is governed to a considerable extent by weather conditions, which cannot be forecast, the necessity for topping may quite well arise even under highly efficient management. Normally, because of its stemmy nature, the topped growth is not of high value for milk-production. Dry stock often may be employed advantageously to remove such growth, which stock consume readily when it has become partly wilted, although they neglect it before it is mown. Even if it is impossible to provide for the consumption of the wilted, topped growth, it is sound practice in the interests of the future production of the sward to carry out topping made advisable by the nature of the growth. Topping may prove of distinct value in reducing the shading effect of tall weeds, which at times become established as the result of the breaking of the sward in the manner that is likely to occur in a wet winter or spring.

For thoroughly efficient control of the growth of pastures in summer ensilage and topping usually have to be linked suitably with systematic grazing. That suitable systematic grazing is not at all intricate may be gauged from the fact that the essential steps in effective grazing on many farms are the following simple ones :—

1. Rapid grazing of fields by relatively heavy stocking. Stocking at the rate of from six cows an acre upwards for periods of from one to three days has in practice given excellent results.

2. Subsequent complete " spelling " of the pastures to allow of recovery sufficient to give the amount of grazing already specified. According to the season of the year spells of from seven to fourteen days' duration have given good results.

Relatively hard grazing of the pastures is at no stage necessary—indeed, it is undesirable. Hence, systematic effective grazing does not call for punishing treatment of either the stock or the pastures. Intensive subdivision is not needed. Splendid results are being obtained on farms on which nine to twelve paddocks are under grazing. Of practical moment is the further fact that on many farms on which the subdivision is as good or better than this the results in respect to pasture utilization are far from satisfactory. These latter farms provide instances of unexploited facilities, of outlay from which potential returns are not obtained. On such farms, which are numerous, better utilization and increased consequent revenue could be obtained without any expenditure.

Ensilage.

Probably some who should practice ensilage still hesitate to do so because of the belief that it is either unduly laborious or that it calls for special experience. While it can be made laborious, it also can be made a light task, and a main objective should be the elimination of all tedious, unnecessary effort. The work relative to ensilage can be lightened greatly by intelligent preparation, for which there is still ample time on many farms. Conveniently located ensilage pits or trenches may yet be made. It is significant that in leading grass-farming districts trenches have grown in popularity in recent years. This is because suitable locations for trenches, which are really modified shallow pits, can be found on most farms. Experience shows that drainage is not of special moment in selecting sites for trenches, although, of course, a really badly drained site should be avoided. Trenches appeal to many because they can be made so readily and cheaply with horse labour. Further, not only do trenches reduce the labour of handling the heavy green material, but they allow of its being so well compacted by trampling, &c., that the wastage is reduced to a practically negligible quantity. Detailed information about the construction of trenches is available from local officers of the Fields Division.

Ensilage, far from being an intricate process, is considered by those with experience of it to be as a rule simpler and productive of much less worry than is haymaking. After very little experience it is possible to dispense with the taking of temperatures in determining the progress that it is advisable to make ; additional green material should be added to that already gathered as soon as the latter commences to sink in height because of the ensiling process. If this rule is followed, temperatures in the vicinity of 100° F. will develop and silage of a greenish to a yellowish tint usually will result. To follow this rule when the stack system is employed, if the weather is mild and there is not excessive water associated with the green material, it is usually necessary to proceed daily with the ensilage, but if the weather is cold and the green material contains much moisture because of either the weather or the stage of its growth, then it is likely to be advisable to refrain from bringing in green material on occasional days, especially in the early stages.

In pits and trenches where the partial exclusion of air may check the rate of the ensiling process, slower gathering of the green material than is advisable in the stack system is likely to be suitable. The production of the greenish to yellowish type of silage involves less loss in nutritive value in the actual ensiling process and results in a more digestible type of forage than does the production of brown to black silage. Even when care is exercised, late harvesting of the crop is likely to beget undesirably dark silage, unless the work is speeded up relatively to the procedure which suits for green succulent material. Late ensilage is further undesirable because it leads to—

(1) Less likelihood of a substantial leafy aftermath, which is usually of especial value in midsummer :

(2) Increased harm to permanent pastures due to prolongation of the shading effect of the tall growth :

(3) Unduly woody silage, which, irrespective of the curing process, is associated with the poor balance in the supply of nutriment and the poor digestibility that characterize any overmature pasture growth.

Early ensilage is specially advisable in the first cut of the season from a lucerne area. This is so because the first cut often contains a considerable proportion of weeds, and the longer such weeds are left unmown the more they weaken the lucerne-plants.

To sum up, inefficient ensilage commonly results in the presence of one or more of the following conditions :—

(1) Working at excessively high temperatures, which results in avoidable loss in quality. This may be remedied by more speedy work. Partial wilting of the material may also lead to excessively high temperatures, though in dealing with very succulent material partial wilting may be advisable.

(2) Too late cutting of the green material, which normally begets a falling-off in quality that outweighs any increase in quantity.

(3) Insufficient exclusion of air, which begets wastage due to decay ; this may be remedied by more thorough packing in the pit or trench and by a more adequate covering of earth or other sealing material, which, to minimize wastage, should normally be placed in position practically as soon as all the green material has been gathered.

The Supplementary Crop Position.

At this season more and better work should be carried out in respect to such important supplementary crops as mangels, swedes, turnips, lucerne, chou moellier, and carrots. Top-dressing, ensilage, systematic grazing, all are of great known value, but for maximum success it is frequently necessary to reinforce them by judicious forage cropping. It is often asked to what extent should the plough be used on farms on which grass is the dominant crop. Relative to this matter detailed guidance capable of general application cannot be given with any measure of safety, but as a rule arable cropping should be given a place when two commonly occurring circumstances are present.

In the first place, generally, it will prove advisable when some of the pastures on a farm could be improved economically by ploughing, growing intermediate crops, and eventually resowing to pasture. In the second place, it is generally advisable to grow arable crops such as mangels, chou moellier, &c., when this can be done without necessitating a substantial direct outlay in equipment or labour. And this will apply as a rule even to farms the pastures of which are not badly in need of improvement by means of renewal. In short, if the work involved can be done without

detrimentally affecting the routine farm work and without necessitating the employment of additional labour, then almost certainly cropping should be carried out. Many farmers err not by omitting supplementary cropping altogether, but by not doing enough to meet properly the feed requirements of the stock during periods of shortage of feed from pastures.

Factors in Successful Cropping.

Despite the fact that the value of cultivation has been stressed through the centuries from classical times, poor cultivation is probably the most potent underlying cause of unnecessarily and unprofitably low yields. Expenditure on good seed and suitable fertilizer is at times at least partially ineffective because of lack of cultivation. Preparatory cultivation, which is of prime current importance, should provide for most arable crops a layer of soil fine, firm, and mellow to the full depth disturbed by the plough. Only by beginning the preparatory cultivation in good time can this be obtained economically. To some extent potatoes are an exception, in that they are favoured by a loose condition of the soil.

The saving of a few shillings and even a few pence an acre on seed sometimes is welcomed ; almost always it really is parsimony instead of economy. Usually the small saving is associated with one or all of the following : Poor germination, low vigour, poor type or strain. Complete or partial failures of crops which it is customary to attribute to unfavourable weather or to attacks of pests have been traced to low germination or to impaired vitality, leading to puny seedlings that succumb under adverse conditions that strong seedlings would withstand.

It may be taken as a practical rule in cropping that high production is dependent on high fertility, and consequently that liberal manuring is frequently advisable. In general, while the overmanuring of forage crops is practically unknown, the undermanuring of them is commonplace. Probably manuring of forage crops would generally be more liberal were it more widely realized that the value of 1 ton of even the least nutritious of ordinary forage crops is more than the cost of 1 cwt. of the fertilizer commonly used with them, and the response to fertilizer is certainly abnormally meagre if it does not lead to an increase in yield in excess of 1 ton an acre.

Root Crops.

The mangel is especially reliable both because it can withstand a period of dry weather relatively well and because it is not subject as yet in New Zealand to any serious disease or pest. Over wide areas, as the result of suitable treatment, crops of 60 tons or more an acre are frequently grown. Good treatment for the mangel is particularly desirable, and thorough preparatory cultivation to produce a fine, firm, seed-bed is an important feature of such treatment.

As the result of yields noted in the field the variety Prizewinner Yellow Globe deserves its outstanding popularity. Other varieties of known value are Red Intermediate, White Sugar, and Jersey Queen. Current practice which generally gives good results is to sow about 6 lb. of seed an acre in rows 26 in. to 28 in. apart. Over wide areas November sowing is suitable. In wet, cold conditions, which tend to cause loss or stunting of seedlings, sowing should be deferred until warm conditions obtain.

Though knowledge of the manurial requirements of the mangel is imperfect, it has been established that as a rule good results may be expected from a dressing of 5 cwt. to 6 cwt. an acre of a mixture consisting of equal parts of superphosphate and blood and bone or three parts of superphosphate to two parts of blood and bone. It is significant that in farmers' field competitions outstanding yields are so frequently linked with very rich soils—*e.g.*, old pig-yards, &c.

On free-working loams the field carrot, given good cultivation, is capable of heavy yields—ones of approximately 70 tons an acre have been recorded.

It is usually profitable to apply 3 cwt. to 5 cwt. an acre of a fertilizer mixture consisting of two parts of superphosphate to one part of blood and bone. Varieties which have been consistently popular are Matchless White, Barriball, White Belgian, and Guerande. Guerande, which is a very suitable variety for sheep, is grown successfully, without thinning, in rows 21 in. to 26 in. apart, 1½ lb. of seed per acre being used. With other varieties good results are commonly obtained by hand-thinning and cultivating crops sown in drills 21 in. to 26 in. apart, but sowing in drills 14 in. apart also gives heavy yields. Sowing 1 lb. to 1½ lb. of seed an acre in November usually gives good results.

Lucerne.

Rapid and vigorous growth of lucerne seedlings is desirable, and is favoured by warmth. Because of this, best results are usually obtained by sowing during the latter part of November or in early December. It is good practice to sow through every coulter of the grain drill 12 lb. to 18 lb. an acre of Marlborough seed. Alternatively, the seed may be broadcast and covered by light harrowing. A fine firm seed-bed is required for fullest success with this valuable crop. As a rule, lime may be applied advantageously before the final cultivation preceding seed-sowing. Treatment of the seed with suitable cultures, which are obtainable at a small cost from the Department of Agriculture, is advisable. Full information about this and lucerne culture generally is contained in Bulletin No. 155, which is available for free distribution.

R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Control of Pests and Diseases.

In times such as the present, when low prices for fruit usually have to be accepted, it is particularly important for growers to pay special attention to cultural practices and orchard management generally. Without a high state of efficiency in these, profit from fruitgrowing is not to be expected. There have been seasons when a profit could be shown on orchards managed in a haphazard way, but conditions have now changed, and growers who are unable to keep up with the ever-varying methods of good orchard management are doomed to disappointment. Success is largely dependent on producing consistently good crops of fruit of the desired size, free or almost free from disease or insect injury, and at the least possible expense. While the expense must be studied, it should invariably take second place to the other essentials.

Sprays recommended in last month's notes should be applied as the different varieties reach the correct stage of growth, aiming always to make the applications a few days on the early side rather than the late, to allow for the risk of unfavourable weather delaying the operation. For apple-trees it is particularly important to apply the petal-fall spray early where powdery mildew has to be contended with. Lime-sulphur, 0·1 per cent., colloidal sulphur, 2 lb. per 100 gallons, and lead arsenate, 1½ lb. per 100 gallons is an extremely efficient combination spray, and when applied early seldom affects the setting of the fruit from the late blossoms. The second post-blossom spray should consist of the same combination, applied from ten to fourteen days after the petal-fall spray.

Leech is likely to make its appearance on the leaves of the pear, plum, and cherry at an early date. This pest is readily controlled by periodical sprayings with lead arsenate, 1½ lb. per 100 gallons. The first application

should be made immediately the leech or leech-eggs are observed. At this time the fruit is not far advanced, and is not likely to have its appearance marred by the spray. Good control of this pest early in the season may make it unnecessary to stain the fruit when nearing maturity by further applications of lead arsenate.

The importance of constant vigilance for fireblight infection cannot be overstressed. Late-flowering varieties of apples such as Sturmer, Ballarat, Statesman, and London Pippin are most prone to blossom infection. All diseased portions should be severed well below the visible infection and immediately burned.

Cultivation.

Where a good tilth has not already been secured, every opportunity should be taken after rain to secure such a condition. The soil should be kept friable, devoid of lumps, and with an even surface without a crust, so that the smallest surface area is exposed to drying winds, moisture conserved, and aeration maintained. Aeration will materially assist the action of the bacteria in the soil in changing the unavailable plant-food already in the soil and that supplied by manures into a form in which the trees can absorb it, thus stimulating tree growth, helping the development of fruit-buds, and increasing the size of the fruit.

Thinning Stone Fruits.

Thinning of the fruit is usually necessary on most varieties of peach, apricot, and plum. This work is best attended to as soon as the natural dropping is over. Much depends on the vigour of the tree, variety, susceptibility to brown-rot, &c., as to the extent of thinning necessary. It is a good practice to thin heavily on trees making poor growth, leaving a heavier crop to mature on the more vigorous trees. Generally it is advisable to reduce all clusters to single fruits and thin the remaining fruits so that when fully matured the fruit will not be touching each other. This is of particular importance in localities where bronze-beetles are usually troublesome, and on varieties very susceptible to brown-rot infection. The leaf-roller caterpillar that frequently injures the stalks of apricots is also more readily kept under control if single fruits only are allowed to remain.

Grafts.

Trees that have been grafted in the spring will require constant attention. Frequent examinations are necessary to see that the growth of the scion or other shoot growth has not caused the grafting wax to crack. The sealing of such cracks, so as to exclude the air from the union, often saves the death of the scion. In cases where it has become evident by the second week in November that no union has taken place, further scions can then be inserted to take the place of the failures. While this is much later than the recommended date for grafting, satisfactory results can sometimes be secured by grafting during this period, and thus save a year in establishing the scion. The numerous shoots that usually come from the stock should be allowed to remain, provided there is no danger of the scions being crowded. All such shoots should be pinched back periodically so that the scions remain well above the other growth.

—P. Everett, Orchard Instructor, Gisborne.

Citrus Notes.

As soon as soil conditions are favourable during the spring, growers should work the ground to as fine a tilth as possible. At the same time care must be taken not to damage the feeding roots by cultivating too deeply. Thorough tillage of the soil during the spring and early summer is important, and should under no circumstances be neglected.

Soon after the main crop of blossoms has set it is advisable to spray the trees with bordeaux mixture 3–4–50 as a preventive of verrucosis and grey scab, and, as the flowering period is considerably extended, more than one application is necessary to ensure clean fruit. A watch should be kept for scale insects and thrips, which become troublesome in the early summer. The trees should be sprayed with one of the oil dilutions at a strength of from about 1–40 to 1–80 according to the brand of oil used. For the accuracy which is very desirable see Bulletin 161, which is available for free distribution. It would be much safer to make several applications throughout the season at a weaker strength, rather than risk damage by trusting to one application at the greater strength. Moreover, owing to the fact that the red scale hatches out during January and February, it is necessary to keep a sharp lookout and spray accordingly. As thrips are becoming more troublesome, all spraying should be done thoroughly in order to cover the under sides of the leaves.

To allow for the development of the new season's crop all fruit should be removed as soon as it reaches the diameter of about 2½ in. When picking, a sharp lookout should be kept for signs of borer. Small branches affected are easily detected by the wilting of the foliage, and can be cut out and burned. Larger affected branches can be dealt with by injecting benzine into the holes and plugging them with soap or putty.

Trees which appear sickly should be carefully examined for signs of collar rot or bark blotch, and when these troubles are detected they should be treated by the removal of all diseased bark together with a small portion of healthy bark round the edges of the wound, which should then be painted over with bordeaux paste or Stockholm tar.

—L. Paynter, Orchard Instructor, Auckland.

POULTRY-KEEPING.

Special Care of Late-hatched Chicks.

LATE-HATCHED chicks are always at a decided disadvantage compared with the early-hatched bird, so that if they are to develop into desirable stock they must receive the best possible attention after leaving the brooder. Too often the late comers have to follow stock hatched earlier in the season, and are compelled to run on stale and tainted runs, and this is all against their making satisfactory growth. The worst mistake that can be made in this connection is to place the young birds on runs to which adult stock have frequently had access, as the chickens are liable to become infested with internal parasites—worms, coccidiosis, &c. Just as that dangerous disease, tuberculosis, can be passed on from one bird to another through the droppings, so the germs of parasitic life can be transmitted in a like manner. Adult stock may do fairly well when intestinal parasites are present, but to chickens during the developing stage these parasites are fatal. The importance of having the young stock on clean ground whenever it is possible to do so must therefore be stressed. Too many poultry-keepers are not aware that intestinal parasites, worms, &c., are often responsible for heavy losses in comparatively young chickens, say, from eight to ten weeks old. Scores of such cases have come under my notice, and in almost every case the trouble could be traced to tainted ground. Above all, chickens, or, in fact, birds of any age, should not be given access to a manure-heap which has been collected from time to time out of fowl-houses, or intestinal parasites are almost sure to give trouble.

It must be emphasized again that if the young birds are to develop into vigorous and profitable stock they must have all conditions in their favour, and nothing is more conducive to this end than clean ground to run on.

In these notes alternate runs to a poultry-house have always been recommended, in order that the birds may have frequent changes to clean ground after it has been cropped and rested, and long experience in utility poultry-keeping has only strengthened, to my mind, the importance of this practice. On all plants an endeavour should be made to turn over and sow down a certain number of runs each year, so that the young stock, after being transferred from the brooder, may have frequent changes on to clean fresh ground. Many breeders sow down a number of runs with rape, kale, &c., for the reception of chickens after leaving the brooder. This is an excellent idea, as not only are the young birds provided with all the green food they require, but, in addition, they can secure shelter from winds, and the desired shade from the hot summer sun.

The Surplus Cockerel.

The necessity for marketing all cockerels not required for future breeding purposes as early as their age and condition warrant should be kept in mind. There is no greater drain on profits of poultry plants than the keeping of cockerels beyond a marketable stage, say, from four and a half to five months old, or before the adult plumage commences to appear, as it is impossible for a bird to produce feathers and flesh at the same time. The amount of flesh a chicken will put on prior to producing its second feathers is surprising, providing the chicken has been well fed and maintained in a healthy thriving condition from the day it leaves the shell. It is surprising how rapidly birds will lose condition when the second feathers commence to appear. The check in development of flesh with the appearance of the new covering is due not so much to the sudden and new demand on the bird's constitution as to the fact that at this age birds commence to indicate the natural propensities of development even when running by themselves, by sparring and fighting and generally taking considerable exercise, especially with the lighter breeds, all of which checks flesh-production.

If the birds, therefore, are to show a profit, especially in the lighter breeds, they should be marketed before the appearance of the adult plumage. If the birds are allowed to go beyond this stage, and it becomes necessary to put the desired condition on the matured frames, the cost of production may easily prove too great to leave any profit even in the case of a well primed bird. When catering for the high-class table trade it is quite probable that more money will be secured from a prime bird at five months old than will be obtained for it if marketed in good condition at seven months or older, at which stage it is generally termed by poulterers a "stag." At the former stage the frame is covered with delicate flesh, while at the latter stage the flesh is "staggy."

When priming cockerels, it is a good plan to limit the size of the run and so curtail the means of exercise. Under these conditions, and if given ample food, the birds will rapidly produce flesh, and it should be remembered that one fatted bird is worth more than two unfatted, even in markets such as ours, where, owing to the limited number of choice table-birds which reach the market, many of the consuming public have not yet been educated to know what the taste of real choice chicken is. It is inadvisable to try to prime cockerels on inferior or damaged food. If they are to rapidly put on flesh, the food should be sound and fed with a free hand. Only soft food should be given during the priming process, as hard grains are apt to bring on digestive troubles when the birds are confined to a limited space. A suitable mash may be made from two parts of bran and one part each of finely ground wheat-meal and maize-meal, the whole being moistened with hot water or, better still, skim-milk, and mixed to a crumbly mass. Succulent green material may be fed in abundance, but separately, and where skim-milk is available it may be given in large quantities to drink. Those who have prime cockerels for disposal should endeavour to have these sold by weight. For such birds to be sold by the pair as is the common practice

now adopted is an unsatisfactory system both to the producer and the consumer. When selling birds by weight every ounce of flesh means increased profit to the producer and greater satisfaction to the consumer.

Classification of Stock.

One cannot emphasize too strongly the importance of classifying the young birds according to their size and age, remembering that the more evenly the birds are graded and the smaller the number put together the better they will thrive. This applies to the younger members of the flock in particular. It is a common practice, but nevertheless a mistaken one, to feed both the young and the adult stock on the same class of food. Frequently the morning mash contains a high percentage of forcing material, such as meat or meat-meal, and this is supplied to all members of the flock irrespective of age. Such food is specially necessary in the case of the laying bird, particularly when it is intended to cull her at the termination of her laying season. With the young bird, however, such a forcing diet is quite unnecessary. The food supplied at this stage should contain the elements needed to built up frame and bone rather than to develop the egg organs, or, in other words, to encourage prematurity, a condition that the overfeeding of meat is sure to bring about. Generally, after a pullet commences to lay she grows very little, so that if a bird commences to lay at an early age it will remain a diminutive specimen of its breed, and thereby fail to produce a good marketable egg.

It is a sound policy to give a good supply of animal food to chickens, say up to eight weeks old, but from then on and until the pullets are well developed, and particularly if it is observed that the pullets show signs of coming too early to maturity, all forcing food such as meat or its substitutes or even milk should be left out of the ration. Sometimes when meat is withdrawn from the ration the birds will crave for animal food and commence to pick each other, and this is apt to cause heavy mortality. In such cases the only safe course is to place a hopper of meat-meal in reach of the birds at all times. This will certainly not tend to retard the time of commencing the laying period, but in such cases it is better to allow nature to take its course than to have the birds picking each other.

One of the worst features connected with the industry at the present time is the tendency to market smaller eggs. This tendency will never be corrected, but will, on the contrary, be encouraged if pullets are to be forced to commence laying before they are thoroughly fitted for the work. Reference is not made here to the well-developed bird, but to the pullet which commences to lay when only a little more than half the standard weight of its breed.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

Artificial Increase.

ARTIFICIAL increase may be accomplished in several ways, but perhaps the most satisfactory is by means of nuclei and division. A nucleus is best formed of two frames of emerging brood and young bees, one frame of honey, and one containing pollen. This must be completed by a virgin queen or a ripe cell. The nuclei may be utilized throughout the season for the mating of queens for renewal, and at the end of the summer—if two or more are united, or if each one is reinforced by the addition of bees and brood from strong colonies—they may be wintered in safety and will form good stocks for the next season. No surplus can be expected from them the year of their installation.

In dividing it is best to wait till the colony is preparing to swarm and ripe queen-cells appear in the hive. The hive can then simply be split in two by putting half the bees and brood on another stand, taking care to leave queen-cells in each division, and preferably putting as much emerging brood in the half which is to be placed in a new position. This latter precaution is necessary in order to make up the wastage from the field-bees that will return to the old stand. Each hive can then be completed by filling the vacancies by drawn-out combs. The queen-cells in the queenless half will be nursed by the young bees, while those in the half containing the queen will be torn down by the bees when they find the hive depleted. If the apiarist wants to be quite sure of this being done, he may search for the queen and remove her while the division is being made, afterwards putting her in the hive on the new stand. The division method is advocated on account of its simplicity and the fact that there is no necessity for finding the queen before the operation. It is a most effectual preventive of swarming, and saves a great deal of trouble where increase is desired.

Supering.

In most districts November is early enough for the employment of supers, though much depends on weather conditions. If the weather is warm, the hives full of bees, and nectar coming in freely, the supers may now be added at any time. However, it is of no use discouraging the bees by giving additional space before the weather is warm enough to justify it. If increase is required, it is as well to confine the bees to one story till the hive is overflowing with bees. This is almost certain to produce a desire to swarm, and the hive can either be allowed to swarm naturally or be divided artificially. When the first super is put on it is best, if possible, to fill it entirely or partially with drawn-out combs. If only foundation is available one or two combs—not containing brood—may be removed from the bottom story to the top, and sheets of foundation put in their place. On no account disturb the brood until settled weather eventuates. If foundation is used in the super, queen-excluders should not be used, as the bees will rarely travel through the excluders to work the foundation, and will usually swarm. Do not bring excluders into use until the bees are quite accustomed to working in the supers.

Care of Bee-yard.

Before the supers are put on it is advisable to see that the hives are raised well above the ground, so as to provide ventilation underneath and also to prevent the hives becoming a shelter for insects. The bottom-boards should be raised at least the height of a brick from the ground, and they may even be a little higher, though in the latter case the alighting-board should be long and sloping to enable the heavy-laden workers to reach the hive easily if, as so often happens, they miss the entrance when descending at the end of their homeward flight. All grass and weeds should be cleared away from the hives, particularly at the entrances. To save the continual labour of this operation during the spring and summer it is a good plan to skim the weeds from the ground and to spread agricultural salt in the proportion of about 6 lb. per hive to prevent their reappearance for the season. Although this is only a temporary remedy, it should save mowing the grass for at least one season. Whatever the labour, the entrances must be kept free; the bees' lives are all too short and arduous, and the energy wasted in forcing their way through the tangle of weeds sometimes seen in apiaries must amount to a good deal in the course of a season.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Summer Cultivation.

MUCH has been said about the importance of the proper preparation of the land for planting and sowing, especially for perennial crops. But to make the best of all the circumstances some attention is necessary for most horticultural crops after they are planted. If the preparation of the land has been given time as well as labour, weeds will have had time to show up and be eradicated, and so simplify very much the attention necessary after planting. Where fine seeds are concerned such conditions are indispensable. During the early stages of growth of any of these crops the competition of weeds for the supplies of water, air, and light is a serious hinderance to their progress until they have become established. Many soils also are inclined to form a crust which hinders the liberation of minerals by oxidation and bacterial action, and facilitates the liberation of moisture, often to an extent that becomes injurious. To break up this crust and maintain a good tilth, shallow cultivation should be given during fine weather as often as may be necessary; this will also ensure the destruction of weeds in the small seedling-stage when it is most easily accomplished. The cultivation at this stage should usually be shallow, otherwise fresh weed seeds are brought to the surface where they grow, and there is the danger of disturbing the roots of the growing crop. These important operations are too often neglected owing to the amount of work requiring attention at this season and the changeable weather affording few opportunities; but their importance demands that preference should be given to them whenever the soil and weather are suitable. The danger mentioned disappears as soon as the crop covers the ground between the rows—the shade cast keeps the ground moist and discourages the growth of weeds.

The thinning of seedling crops, when necessary, is also an attention that cannot be neglected with impunity. With experience, and a knowledge of the germinating percentage of the seed, it may be sown at a rate which will ensure a good strike, with little or no thinning necessary; but the heavy seeding generally made necessitates thinning as soon as the plants are large enough to handle—it is indispensable where good root crops are to be harvested. Another useful form of cultivation at this season of the year is the summer fallow. By this means land that is seriously infested with bad weeds, such as couch-grass, &c., may be carefully worked during dry weather to collect the roots and dry and burn them. Given good dry weather, a summer fallow is an effective method of cleaning foul land and getting it into high condition for cropping. To begin with, it is advisable to plough no deeper than is necessary to get rid of the weeds.

Vegetable Crops.

In addition to thinning seedling vegetable crops and cultivating the ground, as suggested in the above paragraphs, young celery-plants, in the seed beds and when planted out, should be sprayed with bordeaux 3–4–50 at intervals of about three weeks for the control of leaf-spot, a fungous disease which is the cause of considerable loss annually where spraying is neglected. Dusting young plants of the cabbage family, as recommended in last month's notes, for the control of caterpillars, should also be continued as necessary.

Half-hardy crops should be planted or sown during the early part of November, if it has not been done previously; they include dwarf and tall beans and such gourds as marrows, pumpkins, melons, and

cucumbers. In a rich light moist soil that is well sheltered, these crops should be profitable. Towards the end of that month plant out Brussels sprouts and sow swede turnips. The latter are most suitable for the cooler districts; where it is desired to grow them in the warmer localities an autumn sowing generally produces the better roots.

The celery crop requires a rich soil that is moist at all times; to obtain these conditions on light land, especially in the drier districts, it is necessary to grow the crop in prepared trenches. Such preparation as is necessary should be done in good time, so that the land is clean and well settled before planting takes place.

To keep an asparagus crop in good strong condition, the cutting of the young spears must not be continued for too long a period: a three-year-old plantation may have the young spears gathered for two or three weeks, if the plants are in good condition. This cutting period may be prolonged each year, until about the fifth or sixth year a full cutting season of about eight weeks may be adopted, finishing usually towards the end of the month of November. Then, if the crop lacks vigour in any respect, a good dressing of fertilizers may be applied to encourage the vigorous growth necessary to improve the crop next cutting season. In this regard it is to be remembered the crop is partial to potash, especially if the soil is light.

Tomato Crops.

In the unheated glasshouse the tomato crop usually commences to ripen now, and picking starts towards the end of the month of November. Exhausted leaves about the base of the plant may be trimmed off and carried out and burnt. On light soils inclined to be overdrained a mulch of strawy stable manure may be laid to feed the roots and retain moisture. Where the bottom bunches have set well there is a considerable demand on the plants, and to obtain good bunches higher up on the vines a liquid manure composed of fertilizers in solution should be applied at intervals of about a fortnight. A sharp lookout should be kept for green or white fly, and the house fumigated on their first appearance; black stripe and mosaic disease will require watching owing to its prevalence during past seasons. It is to be remembered the best preventive is good cultural conditions. If these are maintained many troubles are outgrown. There should be no mistake about this—rank growth is not a good normal state for this crop. While the growth should be sufficiently vigorous, it must be of good firm texture, with plenty of blossom. It is at this season that air should be admitted generously if leaf-mould disease is to be avoided. When a large proportion of the foliage is destroyed by this fungus, the fruit is starved and fails to fill out satisfactorily; to avoid this, good ventilation must be maintained continuously, and in hot, close weather ventilation facilities will require to be used to their fullest extent. Resistance will be best, with this disease as with others, where the foliage is stout and firm instead of being thin and soft.

Outside, the tomato crop is just getting established during the month of November. A sharp lookout should be kept for any replacements necessary, as they should be made with as little delay as possible. The work then consists chiefly in removing lateral growth before it exceeds 3 in. in length, and training the plants to one stem. These are tied at intervals of about 1 ft. to the stakes or wires placed there for their support. In very dry districts only are the plants sometimes allowed to crop on the ground without support and very little training; the plants probably being thinned to four growths and stopped after a couple of bunches have set. Cultivation must be maintained meanwhile to suppress weeds and make plant-foods available. In doing this much damage is commonly done by prolonging the period of deep cultivation

and interfering with the roots, thus weakening the plants and disposing them to the attack of any diseases that may be present. Where the land has been well prepared a firm bed with shallow cultivation will usually give the sturdy fruitful growth that is desirable.

A few years ago the small tomato-moth caused some consternation by suddenly destroying fine crops just as the fruit had set, but before it had time to ripen. The attack, which was without precedent, was confined to the collar of the plant, and was unnoticed generally until it was too late. It has been prevented since by spraying, that portion especially, with arsenate of lead during the early summer. Vigilance and prompt action when necessary will prevent this attack recurring: the danger is greatest when long periods of fine weather occur at the season mentioned.

Small-fruit Crops.

In a rich light soil in warm localities Cape gooseberries may now be planted out 3 ft. apart and 6 ft. between the rows. If the land is well prepared the plants will probably have a satisfactory crop annually for two or three seasons, if attention is given them in the way of cultivation and fertilizers. These autumn berries ripen when fruit of that class is rather scarce, and preserves made from them are deservedly popular.

The passion-fruit is another crop which is planted out at this season in well-sheltered localities. It comes into bearing the second season after planting, and with good treatment the crops should be profitable for a period of six or seven years. Plants are sometimes found carrying a heavy crop under very poor conditions, but to maintain a good cropping record and produce well-flavoured fruit the land should be good and well prepared. Plants are now usually set 10 ft. apart and 9 ft. between the rows. The vines are trained on a post-and-wire fence: the posts being 5 ft out and 2 ft. in the ground with two top wires, one on each side of the post, the wire below being 2 ft. from the surface of the ground. A light stake should be inserted and tied to the wires for each plant, which should be set firmly at the base of the stake and trained up it by stopping each lateral after a few leaves have formed.

To maintain moisture in the beds and keep the berries clean, it is necessary to mulch strawberry-beds as soon as the crop commences to set. Mulching is often preceded by a good dressing of guano or other organic or chemical nitrogenous fertilizer which is worked in before the straw mulch is laid. Where straw is not available, rushes make a good substitute between the rows with pine-needles about the plants; any kind of hay is unsuitable owing to the many seeds it contains. The fruit can be very attractive if it is presented in a suitable manner; the demand depends very largely on doing this properly. Clean punnets well filled with selected berries picked with a short stem look well and sell readily. Undersized and misshapen berries should be placed in a separate receptacle for culinary use. All ripe berries must be gathered or they will be overripe at the next picking, and if packed will crush and stain the containers. For local and immediate use the berries should be well coloured; for long distance shipping, especially in warm weather, they should be less mature. In humid localities where brown rot is present long-distance shipping should not be attempted. The realization from a crop depends very much on the careful supervision of pickers to see that these principles are consistently maintained.

The Homestead Garden.

Towards the end of the month of November, when half-hardy annual bedding plants are in their flowering quarters, biennial and perennial

plants, such as wallflowers, stocks, polyanthus, pansies, &c., may be sown, often in prepared beds outside, for autumn planting and flowering during the following spring.

Where it is necessary to lift spring flowering bulbs, they should be carefully marked when in flower and lifted as soon as the foliage turns yellow. They should be lifted at once as soon as this happens, as in many instances the period of rest is very short and growth quickly recommences. Take them up when the soil is dry and spread them in a shaded, airy place to ripen. They should then be placed in shallow boxes, carefully labelled, and stored in a cool ventilated shed until they are replanted.

To obtain the best results in the herbaceous border, staking and tying should now be attended to as required. Well-regulated growth neatly secured will greatly improve the appearance of this section.

Nurseries and public gardens should be visited to study the new roses and other novelties to note their response to local conditions. Success of any kind in the garden depends very largely on carefully studying the reactions of all kinds of plants to the local conditions. It is only by selecting trees, shrubs, and herbaceous plants that are quite suited to these conditions and arranging them in a tasteful manner that a larger measure of success may be attained. With very few exceptions there are possibilities for great improvement along these lines.

—*W. C. Hyde, Horticulturist, Wellington.*

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 9th August to 20th September, 1934, include the following of agricultural interest:—

No. 69977: Weed-killer; W. Cassels-Brown. No. 70572: Electrically heated incubator; L. J. Hayman. No. 71993: Fungicide; Stanco Inc. No. 71556: Pulsator; T. Shiels. No. 71811: Inflation for teat-cup; J. G. Lamb. No. 70631: Opening gates; B. F. Whitney. No. 72455: Pulsator; J. E. Haywood. No. 70529: Preserving meat; J. Brooks, T. Moran, E. C. Smith. No. 71594: Milk-cooler; W. M. Peacock. No. 72568: Comb-honey packing; H. F. Dodson.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

Caseous Lymphadenitis: Relative to caseous lymphadenitis, the annual report of the officer in charge of the Veterinary Laboratory, Wallaceville, states: "While the South Island flocks under trial showed a considerable reduction in numbers affected down to the vicinity of 2 per cent. below which it is difficult to reduce the disease, the North Island flock under investigation has risen from last year's 2·7 per cent. almost to its first-flock percentage of just over 3 per cent. There has been a change in glands affected in the North Island flock, for the majority of the abscesses palpated this year have been found in the supramammary glands. This fact, taken in conjunction with a very much lessened incidence of caseous lymphadenitis in dry ewes, suggests that two factors operating in the North Island flocks under observation are of greater importance than the shearing factor. These are crutching and lamb carriage of the disease from ewe to ewe by mismothering at docking. Crutching wounds must become infected in places other than yards and sheds, and possibly in the more heavily stocked areas some consideration must be given to sheep night camps."

WEATHER RECORDS: SEPTEMBER, 1934.

Dominion Meteorological Office.

NOTES FOR SEPTEMBER.

APART from the rather severe cold spell from the 10th to the 12th, September was a pleasant month with mild temperatures. The greater part of it was dry in nearly all districts, but practically all recorded good rains at some period, and the spring growth of vegetation set in with great vigour. Generally, the season is further advanced than usual, but the reverse is the case in South Canterbury. There is abundant pasture everywhere and stock are doing well. In some localities there were considerable losses of lambs in the cold weather referred to above. Owing to the sodden state of the soil less wheat has been sown in Canterbury than was intended.

Rainfall.—Heavy rains were recorded in the Auckland Peninsula, mainly in connection with two cyclonic depressions which affected that area. Over practically all the remainder of the North Island the rainfall was very much below normal. In the South Taranaki Bight area it was the driest September for many years. In the South Island, Nelson, the West Coast, and parts of southern Otago and Southland experienced a dry month. Elsewhere, chiefly owing to heavy rains on the 24th and 25th, totals were unusually high.

Temperatures.—The reports so far received, with the exception of that for Hastings, indicate that over the North Island temperatures were above the average. At Hastings there was some cold weather at the beginning of the month with some severe frosts, and this caused the mean to be low. In the South Island conditions were very variable. Thus, while Timaru had a cold month, Christchurch and Waimate were rather warmer than usual. The average for the whole Island differed little from normal.

Sunshine.—The amount of bright sunshine was generally about average. Blenheim reports 211·2, Nelson 207·2, Lake Tekapo 188·9, and Napier 175·1 hours.

Storm Systems.—On the 1st some snow fell in the far South in the rear of a depression which had just passed eastward. It failed to extend far northwards, however, and soon ceased.

Between the 3rd and the 6th a rather vigorous cyclonic depression moved from the North Tasman Sea past the extreme north of New Zealand. It produced easterly gales in North Auckland and heavy rains there and in the north-east of the North Island. In the Auckland Peninsula there were rather severe floods. South of the Auckland Province light rain only was recorded.

On the 8th a trough of low pressure lying in a north to south direction advanced on to the Dominion. Next day it passed eastward and was followed by southerly gales. Fairly general rains occurred with some heavy falls, especially in eastern districts. There were also widespread snow and hailstorms. The snow came low down on the hills in both Islands, and the falls were unusually heavy. From the 10th to the 12th was one of the coldest spells experienced this year.

A slight westerly depression passed on the 19th, but without affecting the weather greatly. Throughout the greater part of the month, indeed, it was remarkable how little rain fell on the west coast, even in strong north-westerly winds.

The next storm, that of the 23rd to the 27th, was the one that produced the most rainfall. Large amounts were registered almost generally. A certain amount of flooding occurred again in North Auckland and on the east coast between Timaru and Dunedin. The storm was a depression of cyclonic form which travelled from Cape Maria van Diemen across the North Island to Cook Strait and thence away eastward. North-easterly gales occurred in the north during its passage.

During the last three days a series of westerly depressions began to pass causing north-westerly gales, which gradually extended farther northwards over the Dominion. On the night of the 30th, strong gales occurred about Cook Strait and in the Taranaki and Wellington Provinces. Rain fell in western districts and in the south-west of the South Island was very heavy. To the end of the month, however, the falls elsewhere had been mainly light.

RAINFALLS FOR SEPTEMBER, 1934, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average September Rainfall.	Total for Year to Date.	Average for Year to Date.
			North Island.			
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	6·33	14	1·60	4·90	48·57	43·66
Russell	10·79	11	3·72	3·89	67·06	41·19
Whangarei	7·79	14	3·40	4·85	51·05	49·95
Auckland	2·08	12	0·63	3·70	37·82	34·96
Hamilton	2·64	12	0·67	4·32	33·36	37·43
Rotorua	2·51	9	1·47	5·07	39·15	41·83
Kawhia	2·26	14	0·54	4·57	36·51	40·75
New Plymouth ..	2·05	11	0·85	5·01	39·57	45·32
Riversdale, Inglewood ..	3·86	14	0·84	9·56	60·04	77·16
Whangamomona ..	0·29	3	0·13	7·11	44·23	56·10
Hawera	1·91	10	0·59	3·42	30·12	33·53
Tairua	5·49	14	1·50	4·92	46·18	50·63
Tauranga	4·59	13	1·33	4·34	44·52	40·29
Maraehako Stn., Opotiki	2·73	10	0·88	4·21	36·02	41·94
Gisborne	2·13	9	0·49	2·99	22·22	37·28
Taupo	2·47	9	0·66	3·82	32·05	33·12
Napier	1·92	12	0·63	2·25	22·83	28·22
Hastings	2·07	13	0·63	2·63	19·84	26·05
Whakarara Station ..	5·79	11	1·81	..	39·57	..
Taihape	1·75	12	0·48	3·15	23·36	26·62
Masterton	2·59	13	0·70	3·02	27·99	29·66
Patea	1·70	11	0·50	3·59	29·32	33·03
Wanganui	1·94	11	1·24	2·87	25·74	26·72
Foxton	0·64	6	0·20	2·40	23·77	23·73
Wellington	2·21	11	0·67	3·11	34·28	31·93
			South Island.			
Westport	3·91	17	1·02	8·30	67·38	70·80
Greymouth	4·65	18	0·90	8·09	71·19	73·06
Hokitika	4·55	17	0·92	9·16	71·81	82·25
Ross	5·99	12	1·62	12·43	89·14	94·81
Arthur's Pass	12·85	10	3·05	15·29	123·01	111·36
Okuru, South Westland	17·29	16	..	11·89	..	105·69
Collingwood	4·06	12	2·03	9·31	72·02	71·76
Nelson	1·59	7	0·46	3·64	26·62	28·42
Spring Creek, Blenheim	3·26	8	1·30	2·59	23·68	23·23
Seddon	2·71	11	1·61	2·14	21·97	18·76
Hanmer Springs ..	2·92	14	0·66	4·58	41·45	33·97
Highfield, Waiau ..	2·39	9	0·50	2·99	29·19	25·52
Gore Bay	3·14	12	1·64	2·94	32·21	24·25
Christchurch	2·93	13	1·22	1·73	23·85	19·19
Timaru	2·77	8	0·85	1·92	21·45	16·35
Lambrook Station, Fairlie	3·26	9	0·93	2·18	23·71	18·31
Benmore Stn., Clearburn	2·91	15	0·95	1·93	19·55	17·95
Oamaru	3·27	10	1·17	1·64	19·71	16·08
Queenstown	4·85	13	1·77	2·54	27·59	21·79
Clyde	1·56	9	0·56	1·05	13·88	10·50
Dunedin	6·02	12	2·75	2·73	35·19	26·93
Wendon	2·19	8	0·85	2·42	22·72	21·69
Balclutha	2·68	12	0·93	1·89	27·22	18·16
Invercargill	3·14	17	0·80	3·21	32·05	32·88
Puysegur Point ..	5·08	18	0·86	6·36	53·62	61·71
Half-moon Bay ..	5·12	20	0·94	5·02	38·23	42·94

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

PRECAUTIONS WHEN COW "SLIPS."

P. W. B., Avondale :—

Two days ago I had a cow "slip" her calf in a certain paddock and wish to know—(*a*) For how long should I keep the paddock closed to cattle ? (*b*) Would it be quite safe to work and graze horses, including a mare in foal, in the paddock ?

The Live-stock Division :—

The answers are—(*a*) There is no definite guide as to how long it will take a soiled paddock to be safe, as moisture and heat will indefinitely prolong the virulence of the organism. However, experimentally infected material from cows having been collected and dried has been found to retain its virulence for 120 days but not more than 150. It would be better if you could plough the paddock up after liming and put a crop in. If you run cattle other than in-calf dairy cows for a season, that ought to suffice. (*b*) It would be quite safe to work and graze horses, or mare in foal.

PAMPAS GRASS IN TARANAKI.

A. B. G., Warea, Taranaki :—

I have at the back of my farm some 14 acres of bush in which are numerous clear spaces of about a ¼ acre. These clearings are badly infested with ragwort each year, so that I hope the pampas will be a means of not only having extra winter and drought period feed, but also keeping such weeds as ragwort and blackberry under. If frosts do no material harm to the plant, would the end of July be too early for me to plant ?

The Chief Chemist :—

Pampas will probably do very well in your warm climate, and it would not be necessary to plough the land. No actual experiments have been made to determine how root cuttings of pampas will compete with ragwort at the critical stage when the cuttings are first becoming established. Possibly the ragwort would have to be controlled until the pampas had made a certain amount of growth. It is considered that the end of July would be a suitable time for you to plant pampas in your district.

TREATING MOSS IN UNPLOUGHABLE PASTURES.

G. H. M., Otaui, Wanganui :—

I should be obliged if you will inform me of the best method of eradicating moss from pasture too hilly to be ploughed.

The Fields Division :—

The invasion by moss of a pasture generally indicates certain faulty soil-conditions which are reflected in the lowered vitality of the pasture-covering. As fertility is a dominating factor, it is suggested that you should top-dress with from 2 cwt. to 3 cwt. per acre of a phosphatic manure, such as super or slag. This procedure would invigorate the pasture, and incidentally encourage stock on to the worst areas and bring about trampling and breaking the surface, which in turn would effect a certain amount of soil aeration and suppression of the moss. Moss always thrives best where the surface of the soil becomes poor. If the moss is developed thickly over the surface it may be necessary to use cattle to break it up sufficiently.